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ETHNOLOGY.—*The case of Daniel P.: An example of Seneca healing.*[1] GEORGE S. SNYDERMAN, University of Pennsylvania. (Communicated by W N. FENTON.)

It is unfortunate that despite the vast amount of published ethnological material on the American Indians the student interested in primitive medicine finds many gaps in the data which prevent him from drawing complete and satisfactory conclusions. There is a primary need for a description and analysis of medical practices for each individual tribe; there is an extensive need for actual case studies before the primary need may be satisfied. It is true that an anecdote may prove little or nothing. The one recorded in this paper, however, well illustrates how the Seneca individual doctors went about their business of curing. We have chosen to use "individual doctor" rather than "lay healer" at Dr. A. I. Hallowell's suggestion, since the latter term connotes an individual with little or no training—a person with amateur status. My informants stated that the female doctors mentioned herein had served long periods of "apprenticeships" in order to learn the secrets of their profession. They were considered fully qualified to heal by other members of the tribe. This was as official as a certificate from a State Board of Examiners.

The incident under discussion, which we chose to call the Case of Daniel P., was recently related to us by a Seneca informant.[2] To the best of our knowledge it is the first published material to include a step-by-step description of one type of healing by individual doctors together with some of the underlying philosophy that these people hold toward the patient and the treatment.

The reader will note that two factors are closely intermingled in Seneca healing[3]—specific practices prescribed for a pathological condition and socially accepted attitudes and beliefs attendant with these practices. We do not feel that the practices can be discussed realistically without considering the attitudes and beliefs of the people, for Seneca medicine depends not only on the use of purely medicinal treatments (as we know them), but also upon the use of magico-religious procedures.

Seneca healing takes several forms. A patient may be treated either by individual healers or by a medicine society. The case under discussion is an analysis of the attitudes and beliefs found to surround the treatment of an individual who was doctored by individual physicians. In this treatment

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[2] This group of Seneca live near Quaker Bridge, N. Y.

[3] No attention is given herein to the medicine societies that exist among the Seneca. The reader is referred to Fenton (1941b) for information on this subject; the subject of Seneca herbalism is also neglected in this article. Those interested in this subject may refer to Fenton (1942). Parker (1912) describes witch doctors as "witches who are willing to pit their power against other witches, and medicine men who have made a special study of charms that will offset witch spells" (footnote pp. 27–29). The reader will note that the type of healing herein described has both strong elements of witchcraft, and also elements of medicinal healing.

strong religious principles and practices may be noted. In addition to the faith in the healing properties of the medicine, there is also a reverential feeling toward the medicine itself. This is exemplified in the practice of burying any medicine remaining after the treatment so that it "will not be walked on or otherwise desecrated by man or beast." It is axiomatic that medicine is never thrown away!

Lena Snow, the senior matron of the Turtle Clan, narrated the case, which she witnessed as a little girl. She estimated that Daniel "must have been doctored over 60 years ago," during times when her people "had more faith" in their own medicines and did not resort "to white man's medicines" for every ill that befell them. She attributed the present-day ineffectiveness of Indian medicine to the "lack of faith in their power" (Snyderman, 1948).

MRS. SNOW'S STORY

Daniel P., a Tuscarora who had accepted the Christian faith, became crazy. He kept complaining about the whites. Even though he was bedridden, he wanted to get up and run away into the woods. After a while he became so violent that he had to be held down. Once he ran away into the woods and tried to kill himself with a sword.[4] The Christian doctors tried everything but could not help him. He kept getting worse.

After awhile, his son brought him to an Indian medicine woman, Sarah Dockstetter, who lived near Red House, N. Y. Mrs. Dockstetter prepared medicine which she had successfully used in these kinds of illnesses, but Daniel fought against taking the medicine. If he was forced to take it, he would spit it out. So finally his son took him home to Tuscarora.

Daniel continued to get sicker, so his son brought him back to Cold Spring. This was about two or three weeks later. He took him to see Mrs. Yellow Blanket, a famous herb doctor. Mrs. Yellow Blanket agreed to take the case and got Hiram Watt's mother to help her.[5]

The two doctors prepared about a quart of medicine which Daniel willingly drank shortly before sunrise—about 4 A.M. The medicine made him puke into a pan which I held for him. At sunrise I was ordered to search the pan. I found pieces of gold and silver beads, and I put these into a bottle of medicine which the doctors prepared for this purpose.

Daniel was given a cup of medicine every day for the succeeding seven days and Lena continued to examine the vomit for foreign objects.

The second day I picked out two little black sticks about a quarter of an inch long with fine hair wound around it. The third day I found a small stick with no hair around it. The fourth day I took out a pyramid-shaped black thing. During the following three or four days I found nothing, so the "puking medicine" was discontinued and Daniel was given a strong physic to clean him out.

During the entire cure, Hiram Watt's mother, who acted as Mrs. Yellow Blanket's assistant, soaked Daniel's feet in a special medicine every time he got through puking.

Soon[6] Daniel began to talk sense and look around. He stopped saying "Let's get out—the whites are here and will kill me." He said he could not take Mrs. Dockstetter's medicine because it tasted like chicken dirt, whereas Mrs. Yellow Blanket's medicine not only tasted good but was so strong that it forced him to take hold of the cup and drink it right down without fighting.

According to Mrs. Snow, Daniel P. never manifested the same symptoms again. However, he "felt weak" on one occasion and "went to see a white doctor who ordered him to take a tablespoon of whiskey as a tonic." As a result of this Daniel began to drink steadily. He eventually died a confirmed drunkard. Lena emphasized that "if he had returned to Allegany, he could have been cured because witches caused the whiskey to be bad medicine, and only the Indian doctors could cure anyone who was witched." An essential belief expressed herein is that Daniel's drunkenness is the end result of witchcraft and that the whiskey which was prescribed as a medicine acted as the vehicle for it.

Another consideration is pertinent: The unconscious resentment toward the whites that is found in Mrs. Snow's statement is

[4] Fenton, 1941a, has discussed Iroquois suicides.

[5] The treatment was administered in the home of Mrs. Snow.

[6] Apparently after 10 days' treatment.

commonplace in Allegany even among the Seneca who do not follow the "old way." Resentment toward the whites may be noted also in the case itself. This is seen in the overt fear of further white encroachments which was manifested by Daniel P.'s desire to escape into the woods. To him hiding in the woods may have symbolized the comparative safety from attack that existed prior to the white man. One can collect literally hundreds of statements regarding the significance of the forests to the Seneca people—trees and forests play an important role in Seneca religion and folklore. The fact that white man was primarily responsible for the extensive clearing of the virgin Appalachian forests may have some deep-rooted psychological implications that motivate present-day Seneca attitudes and behavior.

The substitution of the white man's medicine and the concomitant rejection of the Indian medicine merit further comment.[7] Mrs. Snow indicated that it was a "shame that the Indians no longer utilized their own medicine." She stated that because of the efforts of the whites, they had discarded tested cures for hit-or-miss methods. It would be easy to dismiss this as a nostalgic longing of an elderly person if it were an isolated attitude; but we found this philosophy to be held in common by many of the older "Long House People."[8]

However, despite the gradual return of many of the younger people to the Long House, which has resulted in a renaissance of the "old religion," there does not seem to be a similar acceptance of the old faith in healing by individual Indian doctors. And since the medical care to which the younger element avails itself is virtually a white monopoly, the resentment of the individuals believing in lay healing is further aggravated.

Among the Seneca, the belief in the power of the medicine to heal was and still is positively correlated with the actual cure.[9] Thus, Ed. Curry, the present keeper of the "Little Water Medicine," told me of a man who had been given their medicine but who would probably not get well because he had first tried all of white man's medicine and called for the "real medicine" only as a last resort. He decried the fact that many Indians "did not have faith" in their own medicines and used them only when it was too late. "People," he said, "had faith in the medicines, so the medicines worked."[10] To the Seneca believer this is no mere rationalization for the failure of Indian medicine, but prima-facie evidence for the need of a complete return to the ways of the "old people."

Obviously underlying Daniel's treatment is the subject of witchcraft. This phenomenon was so much a part of Seneca thinking that Handsome Lake, the great prophet, defined witches as "people without their right minds" who "make disease and spread sickness to make the living die." Handsome Lake attacked the problem by providing for a method of curing witches rather than curing persons afflicted as a result of witchcraft. His message is still recited at religious functions in the Long House.[11]

Lena Snow indicated that Daniel had been "witched" and that the person "witching him had used his power to make him sick."[12] The good medicine when administered was sufficiently potent to overcome the evil medicine of the witch. The power of Mrs. Yellow Blanket and her assistant was unquestionably stronger than the power of the witch. In fact, it was strong enough to force the patient to take it in large enough doses to ensure a cure.[13] And what is more, it succeeded where Mrs. Dockstetter's medicine failed simply because Mrs. Dockstetter's did not have sufficient power. These were incontrovertible facts.

In conclusion, it may be seen that the Seneca regarded certain types of illness as due to the failure of the individual's personal

[7] The feelings of anxiety that have accompanied acculturation of primitive peoples are discussed by Hallowell (1945) and Fenton (1948).

[8] Virtually the same opinion was expressed by Fannie Stevens, Chauncey Johnny John, Ed. Curry, Charlie Butler, Sherman Redeye, and others.

[9] This would seem to underlie much of our own medicine.

[10] Snyderman, 1948, op. cit.

[11] Parker, *op. cit.* pp. 27–29, for text of Handsome Lake's message.

[12] Fannie Stevens (*ibid.*) stated that "witches could cause people to swallow small skeins of thread, balls of animal hair, needles and beads."

[13] Ackerknecht (1942a, p. 506) calls this "counter magic".

power to protect him from witches who place material objects in his body. Accordingly, the witches destroyed his physical and mental health. The treatment accorded was therefore geared to remove these foreign objects and to act as a positive path for physical and mental health. It was literally a contest between the forces of good and evil. Ackerknecht's statement that primitive peoples do not recognize a dichotomy between physical and mental disease[14] seems to apply generally to the Seneca and specifically to the treatment prescribed for Daniel P. A study of this case also revealed basic fears and anxieties that accompanied white intrusion. These psychological phenomena remain despite Seneca return to some of their old social and religious beliefs and may well be explored by students interested in this problem.

[14] Ackerknecht, 1945, pp. 33–34.

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PALEONTOLOGY.—*A leptictid insectivore from the middle Eocene Bridger formation of Wyoming.*[1] C. LEWIS GAZIN, U. S. National Museum.

During laboratory preparation at the U. S. National Museum of a large *Palaeosyops robustus* skeleton from the Bridger formation, a small insectivore maxilla was encountered in the adhering matrix. Particular interest is attached to this occurrence in demonstrating for the first time the presence in middle Eocene or Bridgerian time, of a leptictid related to the *Diacodon-Ictops* line, bridging a conspicuous hiatus in the recorded geologic range of this group.

The titanothere which the leptictid maxilla accompanied was found by George B. Pearce of the 1930 Smithsonian Institution expedition. The horizon is determined as D_2, according to the stratigraphic subdivisions set up by Matthew.[2]

Its location was approximately 3 miles north of the town of Lone Tree, Wyo., on the north slope of the divide between Sage Creek basin and Henry's Fork, and a little above the "Lone Tree white layer," in $SE\frac{1}{4}$, sec. 18, T. 13 N., R. 113 W.

GEOLOGIC DISTRIBUTION OF LEPTICTIDS

The oldest known probable leptictid is *Gypsonictops hypoconus*, which Simpson[3] described from the Hell Creek and Lance upper Cretaceous, a form surprisingly similar to the later leptictids, indicating this to be a remarkably conservative group and, so far as known, one of the earliest placentals.

Leptictids are rather well diversified in the Paleocene, if one is to judge by the

[1] Published by permission of the Secretary of the Smithsonian Institution. Received March 3, 1949.

[2] Mem. Amer. Mus. Nat. Hist. **9**: 295–297. 1909.

[3] Amer. Mus. Nov. **267**: 6–7, fig. 6. 1927. Also, Mem. Peabody Mus. Yale Univ. **3**(1): 137–138, fig. 53, pl. 32, figs. 3–7. 1929.

number of forms which have been named, but in all, conservative in development, so far as dentitions are concerned. Among the Paleocene forms have been included such genera as *Myrmecoboides*, *Leptacodon*, *Acmeodon*, *Prodiacodon*, and possibly *Xenacodon* in North America alone. The first of these was described by Gidley[4] in 1915, as a marsupial, on the basis of material from the "Gidley Quarry" in the upper Lebo of the Montana Fort Union. Matthew[5] and later Simpson[6] properly referred *Myrmecoboides montanus* to the Leptictidae. *Leptacodon* and *Xenacodon* were named by Matthew and Granger[7] in 1921 for leptictid species from the Tiffany beds, and subsequently species of *Leptacodon* were recognized by Simpson in the Bear Creek fauna[8] (*Leipsanolestes siegfriedti*) and in the upper Lebo[9] of Montana, and by Jepsen[10] in the Silver Coulee horizon of the Polecat Bench series. In 1921 Matthew and Granger[11] also described *Acmeodon secans*, from the Torrejon beds, and more recently *Prodiacodon* was proposed by Matthew[12] for his Torrejon species, *Diacodon* (*Palaeolestes*) *puercensis*,[13] and to replace *Palaeolestes* (preoccupied). *Emperodon*,[14] described first as a Lebo deltatheridiid and then shown[15] to be a synonym of *Gelastops*, appears listed (probably in error) by Simpson[16] in 1945 as a leptictid.

The genus *Diacodon*, based on the species *Diacodon alticuspis*, was first described by Cope[17] in 1875 from the "Wasatch" beds, which Simpson[18] has recently named the San Jose formation, in the San Juan Basin of New Mexico. It is not known whether the type specimen, essentially a lower jaw, was derived from Almagre or the Largo member, but the time difference between these two horizons is probably not so significant as was once thought, and the two are probably not so high in the Wasatchean interval. A second species from these beds, which Cope called *Diacodon celatus*, has since been transferred to the genus *Nyctitherium*, and hence to a different family.

In 1880 Cope[19] described the species *Stypolophus bicuspis*, which he later referred to *Ictops* and to which Matthew[20] in 1899 gave the name *Palaeictops* (not Cope, as Granger[21] in 1910 indicated), but later[22] showed that it properly belongs in the genus *Diacodon*. The *Diacodon bicuspis* type, a remarkably good specimen, including skull and lower jaws, was collected by Wortman from the Wind River beds in 1880. The collection which Wortman made at that time was later interpreted by Granger and by Matthew as coming from the Lost Cabin horizon. A second form from the Lost Cabin beds, *Parictops multicuspis*, was described by Granger[23] in 1910. *P. multicuspis* is known only from a lower jaw which is characterized by larger, more cuspate, and somewhat more shearing premolars. No information is available as to the variability of *Diacodon bicuspis* in this respect, however, in *Ictops* there is a noticeable variation in the extent to which premolar cuspules are developed. Nevertheless, *Parictops* appears from the limited material to be a valid genus.

Certain references to *Diacodon* in Paleocene, as noted above, were later incorporated under *Prodiacodon*. There remains, how-

[4] Proc. U. S. Nat. Mus. **48:** 395–402, pl. 48, figs. 1–1a. 1915.
[5] Science, n.s., **43:** 109–110. 1916. Also, Trans. Amer. Philos. Soc., n.s., **30:** 215–216. 1937.
[6] U. S. Nat. Mus. Bull. 169: 115–118, figs. 17–18. 1937.
[7] Amer. Mus. Nov. **13:** 2–3. 1921.
[8] SIMPSON, GEORGE G., Amer. Mus. Nov. **297:** 6, figs. 3–3a. 1928.
[9] SIMPSON, GEORGE G., U. S. Nat. Mus. Bull. **169:** 113–115, figs. 15–16. 1937.
[10] Proc. Amer. Philos. Soc. **69:** 510–511, pl. 8, figs. 4–5. 1930.
[11] Amer. Mus. Nov. **13:** 3–4. 1921.
[12] Journ. Mamm. **10:** 171. 1929.
[13] MATTHEW, WILLIAM D., Bull. Amer. Mus. Nat. Hist. **38:** 576–579, figs. 6–8. 1918.
[14] SIMPSON, GEORGE G., Proc. U. S. Nat. Mus. **83:** 229. 1935.
[15] SIMPSON, GEORGE G., U. S. Nat. Mus. Bull. **169:** 107–110. 1937.
[16] Bull. Amer. Mus. Nat. Hist. **85:** 48. 1945.
[17] COPE, EDWARD D., Engineer Dept., U. S. Army, Geogr. Expl. and Surveys West of 100th Meridian, 1st Lt. Geo. M. Wheeler in charge, pp. 11–12. 1875.
[18] Amer. Journ. Sci. **246:** 258. 1948.
[19] Amer. Nat. **14:** 746. 1880.
[20] Bull. Amer. Mus. Nat. Hist. **12:** 35. 1899.
[21] Bull. Amer. Mus. Nat. Hist. **28:** 250. 1910.
[22] MATTHEW, WILLIAM D., Bull. Amer. Mus. Nat. Hist. **38:** 574–576, figs. 3–5. 1918.
[23] Bull. Amer. Mus. Nat. Hist. **28:** 250–251. fig. 6. 1910.

ever, the occurrence of *Diacodon minutus* Jepsen[24] in the Silver Coulee horizon of the Polecat Bench in Wyoming, and of *Diacodon septentrionalis* Russell[25] from the Paskapoo of Alberta. The age of the Wyoming material is not in doubt, but the Alberta occurrences are described in association with materials which do not appear compatible, such as *Chriacus* and *Meniscotherium*.

Eocene leptictids of later than Bridger time include Peterson's[26] *Protictops* from the Duchesne River beds and possibly *Sespedectes* described by Stock[27] from the uppermost Eocene equivalent of the Sespe in California. The culminating stage in North America is seen in the White River Oligocene forms, *Ictops* and *Leptictis*, the earliest described[28] members of tbe family. Species of *Ictops* are abundantly represented in the Chadronian and Orellan intervals, but *Leptictis* remains known only from the type specimen of *L. haydeni*. It has been suggested before that this specimen may be an abnormal individual of *Ictops dakotensis*. *Mesodectes* Cope[29] is regarded as a synonym of *Ictops*, and *Metacodon* Clark[30] is described as a survival into Oligocene time of the *Leptacodon* type of dentition. Patterson and McGrew,[31] however, transferred *Metacodon* to the Erinaceidae on evidence furnished by additional materials from the Brulé White River beds.

Hypictops[32], n. gen.

Type.—Hypictops syntaphus, n. sp.

Generic characters.—Upper premolars relatively large. Molars broad lingually. M^3 unreduced. Parastyle exceedingly well developed on P^3, but apparently weak on succeeding cheek teeth. Cingula very weak on all teeth and hypoconal crest joining protocone at a decidedly basal level.

Hypictops syntaphus[33], n. sp.

Type.—Right maxilla with P^2 to M^3 and part of P^1; U. S. N. M. no. 13445.

Horizon and locality.—Upper Bridger (D_2), about 3 miles north of Lone Tree, Bridger Basin, Wyo.

Specific characters.—Size near that of *Diacodon bicuspis*. P^4 to M^2 smaller than in *Ictops dakotensis*. Specific characters for the most part not distinguished from those of the genus.

Description.—The teeth (see Fig. 1) in the maxillary portion of *Hypictops syntaphus* are well preserved, but at the same time rather well worn. Only the basal portion of the two rooted P^1 is preserved, and P^2 is not complete anteriorly. The remaining cheek teeth are essentially complete, except for slight damage labially to the adjacent root portions of M^1 and M^2.

The premolars of this form are of relatively large size in comparison with other leptictids, with the primary cusp in P^2 and P^3 transversely broad and robust. The tritocone or metacone on both is high and well defined, more noteworthy for this in P^2. The presence or absence of a parastylid on P^2 cannot be determined, but on P^3 this cusp is high and prominent. It is but slightly developed and very basal in position in P^3 of *Diacodon bicuspis*, and weak or vestigial in *Ictops*. *Diacodon tauri-cinerei*[34] exhibits a moderately strong, but decidedly lower, cusp in this position. The deuterocone portion of P^3 shows strong wear but is prominent and anteroposteriorly broad. A slight cingulum is present only along the posterior margin of the tooth and posteroexternal to the tritocone.

The succeeding molariform teeth have exceedingly weak external cingula, not at all like lower Eocene *Diacodon*, or the Paleocene forms which in turn exhibit an even more noticeable development of this character. The reduction of the external cingulum, though greater, is more nearly comparable to that in *Ictops*. The para- and

[24] Proc. Amer. Philos. Soc. **69**: 511–513, pl. 9, figs. 7–9. 1930.
[25] Amer. Journ. Sci. **17**: 166–168, 173–175, fig. 2. 1929.
[26] Ann. Carnegie Mus. **23**: 374–375, fig. 1. 1934.
[27] Proc. Nat. Acad. Sci. **21**: 218–219, pl. 1, figs. 6–6a. 1935.
[28] Leidy, Joseph. Proc. Acad. Nat. Sci. Philadelphia **20**: 315–316. 1868.
[29] Engineer Dept., U. S. Army, Geogr. Expl. and Surveys West of 100th Meridian, 1st Lt. Geo. M. Wheeler in charge, p. 30. 1875.
[30] Ann. Carnegie Mus. **25**: 310, pl. 26, figs. 1–2. 1937.
[31] Publ. Field Mus. Nat. Hist., Geol. ser. **6**: 257–269, figs. 66–72. 1937.
[32] ὑπό, under; plus *Ictops*: in allusion to its stratigraphic relationship.
[33] σύνταφος, buried with: in allusion to its burial with *Palaeosyops robustus*.
[34] Jepsen, Glenn L., Proc. Amer. Philos. Soc. **69**: 124–126, pl. 3. 1930.

metastyles, nearly obliterated by wear, were, apparently, not particularly well developed, at least not in the true molars. There is some evidence through tooth spacing and root placement that P^4 may have had a moderately developed parastyle and metastyle, though scarcely as much as in *Diacodon bicuspis* or *Diacodon tauri-cinerei*. The lingual portions of the molariform teeth are broad and elongate, not so acute lingually as in *Diacodon* and earlier forms in general, or so arcuate as in *D. tauricinerei*. The lingual portions of these teeth resemble more nearly those in *Ictops*, but with the hypocone not so highly placed on the posterior wall of the protocone. The hypoconal crest is separate from the protocone to a more basal position. A very slightly developed anterior cingulum is present on the forward wall of the protocone of each of these teeth. Lastly, the third molar is well developed, resembles that in *Ictops*, but is less reduced in size and without the cingulum around the lingual margin of the tooth.

Discussion.—It seems possible, from the limited information available, that *Hypictops syntaphus* is closely related to *Parictops multicuspis* Granger from the Lost Cabin horizon. The latter was described from a lower jaw, but the relatively large size of the lower premolars and the development of highly placed cusps on the anterior and posterior margins of the protoconids of these teeth is suggestive. A Princeton specimen (no. 13419) from Cottonwood Creek in the Wind River Basin, hence probably Lysite in age, resembles *Parictops multicuspis* and has certain upper teeth exposed, including the second, third, and part of the fourth premolars, as well as a third molar. The crowns of P^2 and P^3 are partly broken down, but P^2 exhibits anteriorly a very small, basal parastyle, a medianly elevated tritocone, and a small posterior cingular cusp. P^3 exhibits a parastyle as in *Hypictops syntaphus*, but there is evidence of a posterior cingular cusp as in P^2, not present in these teeth of the Bridger form. The premolars are little more than half the size of those in *H. syntaphus*. P^4 is too incomplete for comparison, but M^3 is relatively much narrower transversely and has a far better developed hypocone than in *H. syntaphus*.

Little can be said at this time, without a more comprehensive review of all the leptictid material, as to the phylectic lines within the family, or as to whether more than one line can be certainly defined. In any case, it appears that *Hypictops syntaphus* differs from both *Diacodon* and *Ictops*, but can not be regarded as intermediate in all respects to these two. *Hypictops* may be derived from *Diacodon*, possibly through *Parictops*, whereas *Ictops* appears more likely to have been derived from *Diacodon* through some other line.

MEASUREMENTS IN MILLIMETERS

Length of dentition P^1 to M^3, incl.	23.0
Length of premolars	14.8
Length of molars	8.3

	P^1	P^2	P^3	P^4	M^1	M^2	M^3
Anteroposterior diameter externally	2.6	c3.8	4.3	3.5	c2.9	c2.9	2.5
Anteroposterior diameter lingually				2.3	2.4	2.3	1.9
Transverse diameter at right angles to tooth row	1.2	1.5	3.1	4.4	4.6	4.8	3.9

c, approximate.

FIG. 1.—*Hypictops syntaphus*, n. gen. and sp.: Occlusal view of right upper dentition, P^1 to M^3, incl. U.S.N.M. no. 13445. ×4. Drawing by William D. Crockett.

PALEOBOTANY.—*Pliocene plants from Cachee Valley, Utah.*[1] ROLAND W. BROWN, U. S. Geological Survey.

The fossil plants described here are the first from the Pliocene of Utah. They were collected by J. Stewart Williams, of the Utah State Agricultural College, Logan, Utah, from eastward-dipping outcrops of grayish white, thin-bedded, tuffaceous marl of the Salt Lake formation, in the left bank of Little Bear River in SE¼, sec. 20, T. 10 N., R. 1 E., between Hyrum and Paradise; and from platy, gray limestone in sec. 13, T. 12 N., R. 2 W., about 10 miles west of Logan, Utah. Besides plants, the strata also contain insect remains, ostracods, fresh-water mollusks, fish bones, and bird feathers.

According to Williams (7, pp. 1147, 1160) the Salt Lake formation in the Cache Valley of Utah unconformably overlies Paleozoic rocks and comprises tuffaceous marls, limestones, oolites, sandstones, and conglomerates that crop out in irregular patches in the foothill benches around the margins of the valley. The strata represent sediments deposited in a lake that occupied what is now a graben whose limiting faults coincide roughly with the valley boundaries. The maximum altitude of the outcrops approximates 6,000 feet or more.

Plant material from the Salt Lake formation is relatively scarce, and such as is found is fragmentary, which is evidence of destruction caused probably by attrition in the course of fluvial transportation out of the hills to the basin of deposition. Only the tougher and smaller leaves, some seeds, and broken pieces of stems survived the journey. The most abundant plant is a rootstock that resembles those of horsetails but is probably from a monocotyledon such as a grass or sedge that grew along the lake shore or on the banks of the lower reaches of tributaries to the lake. Some plant species are represented by only one specimen and its counterpart, and, consequently, characterization or identification of these specimens should be considered tentative, pending the accumulation of further material.

[1] Published by permission of the Director, U. S. Geological Survey. Received March 9, 1949.

SYSTEMATIC DESCRIPTIONS

GYMNOSPERMS

Juniperus sp. Fig. 2

The leaves of this fragmentary twig are scalelike and opposite one another in pairs. Although this twig resembles those of *Chamaecyparis*, *Juniperus*, and *Thuja*, the likelihood is that it came from a juniper like the Utah juniper, *Juniperus utahensis* Lemmon.

CONIFEROUS NEEDLE Fig. 1

This broken needle is conspicuously grooved, suggesting the genus *Abies*, but it may represent a pine. No cone scales or other pertinent remains occur in the collection to aid in its identification.

ANGIOSPERMS

MONOCOTYLEDONS

GRASS Fig. 8

The collection contains numerous fragments similar to that figured. As no sheaths indicating *Equisetum* are present at the nodes, it is likely that these rootstocks represent a grass.

DICOTYLEDONS

SALICACEAE

Salix sp. Fig. 13

This willow leaf with the serrate margin and conspicuous intersecondaries has some resemblance to specimens referred to the fossil *Salix hesperia* (Knowlton) Condit (*3*, p. 316, pl. 53, fig. 1), but I hesitate to make this definite assignment without corroborative material.

Salix paradisensis Brown, n. sp. Fig. 23

Leaf lanceolate, coarsely serrate, with a short, stout petiole. Secondary veins numerous but intersecondaries few. The specimen resembles some of the leaves of *Salix scouleriana* Barratt and of the pussy willow, *S. discolor* Muhlenberg.

Salix williamsi Brown, n. sp. Fig. 24

Leaf oblanceolate, with rounded apex, cuneate base, and entire margin. The secondaries are closely spaced but intersecondaries are scarce. Petiole short. The leaf resembles those of

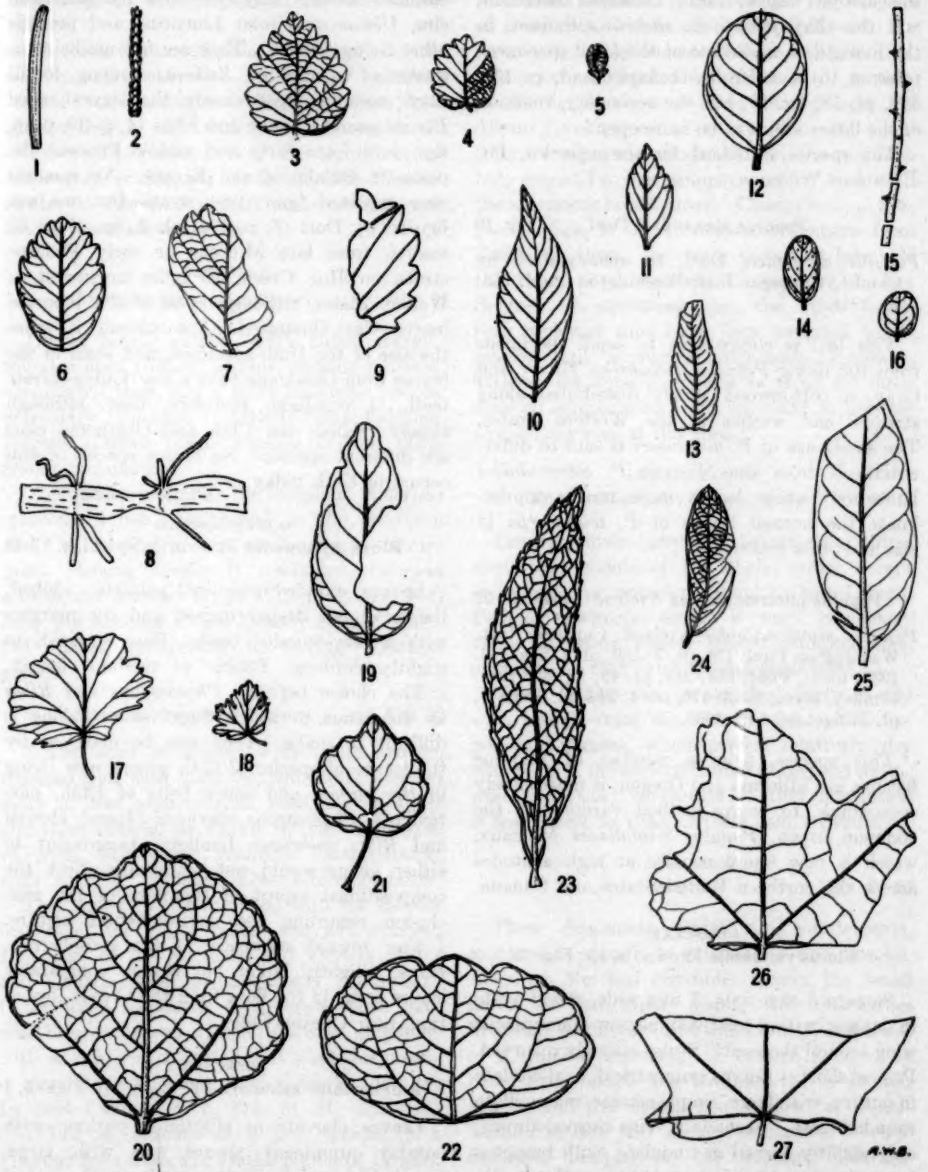

FIG. 1.—Coniferous needle. FIG. 2.—*Juniperus* sp. FIGS. 3–5, 9.—*Ulmus venustula* Brown, n. sp. FIGS. 6, 7.—*Amelanchier apiculata* Brown, n. sp. FIG. 8.—Grass. FIGS. 10–11.—*Rhus salilacualis* Brown, n. sp. FIG. 12.—*Amorpha hesperia* Brown, n. sp. FIG. 13.—*Salix* sp. FIG. 14.—*Amorpha glandulata* Brown, n. sp. FIG. 15.—Spiny stem. FIG. 16.—Unidentified leaf. FIGS. 17–18.—*Ribes hyrumense* Brown, n. sp. FIG. 19.—*Populus alexanderi* Dorf. FIGS. 20–22.—*Populus pliotremuloides* Axelrod. FIG. 23.—*Salix paradisensis* Brown, n. sp. FIG. 24.—*Salix williamsi* Brown, n. sp. FIG. 25.—Unidentified leaf. FIGS. 26–27.—*Acer* sp.

the arroyo willow, *Salix lasiolepis* Bentham, and the silky willow, *S. sitchensis* Sanson, in the living flora and some of the fossil specimens referred to *S. wildcatensis* Axelrod (*3*, p. 132, 341, pl. 58, fig. 2), but the secondary venation of the latter seems to be more open.

The species is named for the collector, Dr. J. Stewart Williams.

Populus alexanderi Dorf Fig. 19

Populus alexanderi Dorf, as synonymized by Condit, Carnegie Inst. Washington Publ. 553: 40. 1944.

This leaf is comparable to small specimens from the living *Populus trichocarpa* Torrey and Gray, a cottonwood widely distributed along streams and washes in the Western States. The small size of *P. alexanderi* is said to differentiate it from the Miocene *P. eotremuloides* Knowlton, whose leaves more nearly approximate the normal leaves of *P. trichocarpa* in size and other features.

Populus pliotremuloides Axelrod Figs. 20–22

Populus pliotremuloides Axelrod, Carnegie Inst. Washington Publ. 476, pt. 3: 169, pl. 4, figs. 1–3. 1937; idem, Publ. 553; 281, pl. 48, fig. 6. 1944. Chaney, idem, Publ. 476, pt. 4: 214, pl. 6, fig. 4; pl. 7, figs. 1c, 1d. 1938.

This species, from a number of Pliocene florules in California and Oregon, is most closely comparable to coarse-toothed variants of the common aspen, *Populus tremuloides* Michaux, which is now found usually at high altitudes across the northern United States and Canada.

ULMACEAE

Ulmus venustula Brown, n. sp. Figs. 3–5, 9

Samara 5 mm long, 3 mm wide, round-ovate in outline, with a relatively narrow membranous wing around the seed. Styles strongly incurved. Pedicel short. Leaves symmetrical, oval-cordate in outline, with large, simple-serrate, mammillate rounded teeth. Secondary veins craspedodrome, only slightly curved or undulate, with branches into the angular sinuses between the teeth. Petioles short.

I find no satisfactory match for the small samara, either among living or fossil species of *Ulmus*. The leaves also remain unmatched, although similar, symmetric, simple-toothed cordate variants may occur on the American elm, *Ulmus americana* Linnaeus, and perhaps other living species. They are not unlike some leaves of species of *Zelkova*. Among fossils they resemble most closely the leaves called *Ulmus moorei* Chaney and Elias (*4*, p. 39, pl. 6, figs. 1–5) from early and middle Pliocene deposits in Oklahoma and Kansas. No samaras were reported from those strata, but one was figured by Dorf (*5*, p. 116, pl. 2, fig. 4) as *U. moorei*, from late Miocene or early Pliocene strata on Hog Creek, 10 miles northwest of Weiser, Idaho, although none of the reported leaves was illustrated. The samara is twice the size of the Utah specimen, and some of the leaves from Oklahoma have a few double-serrate teeth. I conclude, therefore, that, although closely related, the Utah and Oklahoma elms are different species. No native species of elm occurs in Utah today.

SAXIFRAGACEAE

Ribes hyrumense Brown, n. sp. Figs. 17–18

Leaves rounded-orbicular, palmate, 5-lobed, the lobes not deeply incised and the margins with a few rounded teeth. Base squarish to slightly cordate. Petiole of medium length.

The choice between *Physocarpus* and *Ribes* as the genus to which these leaves belong is difficult to make. They can be matched by the leaves of species of both genera now living in the pinyon and aspen belts of Utah, particularly *Physocarpus alternans* (Jones) Howell and *Ribes inebrians* Lindley. Assignment to either genus would not materially affect the compositional aspect of the flora or the conclusion regarding the environmental picture. I lean toward reference to the gooseberries, *Ribes*. Slightly larger but closely comparable leaves occur in the flora from the Creede formation, near Creede, Colo.

ROSACEAE

Amelanchier apiculata Brown, n. sp. Figs. 6, 7

Leaves obovate or elliptic in outline, with notably prominent apexes and with large, rounded, forward-pointing teeth on the apical half of the margin. The secondary veins are distinctly curved, somewhat irregular or undulate, and enter large teeth when these are present. The veinlets connecting the secondaries have a tendency to be horizontal rather

than diagonal with respect to the base of the blade.

These leaves are like the small leaves of the western serviceberries, *Amelanchier alnifolia* Nuttall and *A. utahensis* Koehne, when these species live in dry situations. Among fossils the species is perhaps most like *A. alvordensis* Axelrod (*3*, p. 255, pl. 44, fig. 3) from Pliocene strata on Alvord Creek, Oreg., but differs in having more acute apexes.

FABACEAE

Amorpha glandulata Brown, n. sp. Fig. 14

Leaflet small, elliptic, with entire margin, rounded apex without a spine, cuneate-rounded, asymmetric base, and a short glandular petiole. Secondary venation markedly camptodrome. Intersecondaries none. Surface of the blade glandular-punctate.

This species resembles the leadplant, *Amorpha canescens* Pursh, distributed in the Southern and Central States, west to the Rocky Mountains. Among fossils it resembles *Amorpha oblongifolia* Axelrod (*1*, p. 111, pl. 9, figs. 2–4) from the Miocene of the Mohave Desert, Calif., but differs particularly in having punctate glands.

Amorpha hesperia Brown, n. sp. Fig. 12

Leaflet oval to elliptic, with entire margin, rounded apex with spiny tip, cuneate to rounded more or less asymmetrical base, and a short glandular petiole, as shown by the transverse wrinkles. Secondary venation camptodrome, with scarcely distinguishable intersecondaries.

This leaflet can be matched with the smaller leaflets of the indigo bush, *Amorpha fruticosa* Linnaeus, of the Southern and Central States and Canada, west to the Rocky Mountains. Other fossil specimens of *Amorpha* have likewise been compared with *A. fruticosa* and some with *A. californica* Nuttall, but what this means is general resemblance, not absolute identity. In 1944 Chaney (*3*, p. 318, pl. 51, figs. 2–4) described *A. condoni* as a new species in a Pliocene flora from The Dalles region of Oregon. The leaflets of this species, according to the published figures, are dominantly acute at the apexes and therefore excite doubts concerning the identification as *Amorpha*. They resemble those of species of *Sophora* rather closely. Axelrod (*1*, p. 202, pl. 38, fig. 4) identified as *A. condoni* Chaney a specimen from the Pliocene of California, which when compared with the type figures raises considerable doubt of identity. The specimen figured by Axelrod (*3*, p. 260, pl. 45, fig. 9) as *A. condoni* Chaney from the Alvord Creek region of Oregon differs still more from the types and Axelrod's previous specimen but, except for size, compares pretty well with the specimens here figured. Chaney's (*3*, p. 348, pl. 63, figs. 1, 2) *A. condoni* specimens from Troutdale, Oreg., also seem to belong here. If the types of *A. condoni* Chaney are in fact *Sophora* or something else, the other fossils here reviewed that have been assigned to *A. condoni* will require reassignment. However, without the type specimens in hand for more detailed comparisons I am reluctant to propose any synonymies at this time.

ANACARDIACEAE

Rhus salilacualis Brown, n. sp. Figs. 10–11

Leaflets elliptic-lanceolate, asymmetric, widest above the middle of the blade, entire except for a few, low, rounded lateral or apical teeth. Petiole extremely short, if any. Secondary veins numerous, closely spaced, camptodrome, except those that enter the marginal teeth.

These leaflets can be matched fairly closely with leaflets from the dwarf sumac, *Rhus copallina* Linnaeus, which prefers relatively dry situations in the eastern United States and southwest to Texas. No sumac of this description is now native to Utah and the Pacific States.

ACERACEAE

Acer sp. Figs. 26–27

These fragments, which are counterparts, are hardly enough to establish a new species. Restored, the leaf resembles closely the small leaves of the sugar maple, *Acer saccharum* Marshall, of the eastern United States, and those of *A. pictum* Thunberg, of eastern Asia. The base seems much too cordate, the lobes too simple, and the sinuses too shallow for identification of the leaf as representative of *Acer bolanderi* Lesquereux, the common Pliocene maple of California. No seeds have been found to assist in the specific identification of this leaf.

UNIDENTIFIED SPECIMENS

SPINY STEM Fig. 15

The spines on this slender stem are distinctly

deltoid like those on *Rubus* and *Rosa*. The spines or prickles on *Ribes* are generally needle-like rather than deltoid, and, consequently, this stem can hardly be regarded as confirming the identification of the leaves herein called *Ribes hyrumense*.

LEAVES

Fig. 16. This is a small, orbicular leaf with a short petiole and looped secondary venation. It may belong with one of the species of *Amorpha*.

Fig. 25. This lanceolate leaf with camptodrome venation and short petiole is not well enough preserved to yield further clues to its identity. It may represent a species of *Quercus*.

CONCLUSION

Although the identified species listed in this collection are few in number and some purport to be new, the total aspect gives a fair clue to the original environmental setting. The presence of an aspenlike poplar and a possible pine or fir points toward fairly high ground for at least part of the flora. The maple, sumac, gooseberry, serviceberry, indigo bush, and juniper probably lived a little lower behind the streamside species of cottonwood, willow, and grass.

The relatively small size of all the dicotyledonous leaves and the elm samara is so striking that it can hardly be attributed to some special selective action in the transportation of plant debris from its source to the basin of deposition, although, as stated in the introduction probably only the more resistant materials were preserved. I think, rather, that it is reasonable to regard the leaves and fruit as normal, mature products and that their smallness reflects the aspect that vegetation tends to assume under rigorous climatic conditions, whether dry, hot, cold, or some combination of these factors. On this evidence and the fairly close similarity in composition of the fossil flora to that living in the dry foothills of Utah and adjacent States today, there is good reason to conclude that the climate represented by the fossils was semiarid and that the flora lived at a not too remote date. The presence of cottonwoods and willows suggests streams that demanded a fair amount of precipitation, probably at least 15 inches annually. The elm, maple, serviceberry, indigo bush, and sumac support this inference and tend to raise rather than lower the mositure requirement.

The semiarid picture of the fossil climate just drawn leads directly to the practical question, What is the age of the flora? The flora, obviously, was derived from ancestors that either developed in the environs of Cache Valley or migrated into the area from more distant regions. As no other flora of the same age or composition has been found in Utah, fossil collections from neighboring States must be inspected for evidence of its probable origin. To the northwest, across the Utah-Idaho boundary, are outcrops of the Idaho formation, a portion of which may be early Pliocene in age. In the vicinity of Weiser, Idaho, they contain a flora of ferns, conifers, and dicotyledons that indicates an average annual precipitation of about 30 inches, which is somewhat less than that for the moist climate indicated by the antecedent Miocene flora from the Latah formation in Washington and Idaho. However, the only genera common to the flora of the Idaho formation and the flora from Cache Valley are *Juniperus*, *Ulmus*, and *Acer*, and of these, the species of *Ulmus* and *Acer*, at least, do not appear to be identical. The flora from Cache Valley represents an even drier environment than that from the Idaho formation. If, therefore, the trend toward aridity in the northern half of the Great Basin continued without distinguishable relapses from the late Miocene onward, the flora from Cache Valley should be younger than that from Weiser in the Idaho formation.

The strata assigned to the later Pliocene of Idaho have yielded horses and other mammals but no plants of any value for correlation purposes.

The Ogalalla formation of the Pliocene of Colorado and Kansas contains chiefly grass and hackberry seeds. Farther south the early and middle Pliocene deposits on the High Plains of Oklahoma and Kansas contain only one species clearly comparable to another in the flora from Utah, namely, *Ulmus moorei* Chaney and Elias.

The Pliocene floras of California, Oregon, and Nevada, which have been extensively

elaborated in recent years, contain, at one locality or another, one or several genera that are also found in the flora from Utah, but I find no close agreement in species and compositional aspect. According to Axelrod (*2*, p. 127, 142) the western middle Pliocene floras reflect a semiarid climate that in general had a pronounced effect on the evolution of local environments and species adapted to them. The derivation of the flora from Cache Valley, therefore, seems to have been from late Miocene and early Pliocene ancestors that by evolution produced species that were adapted to the increasingly arid conditions.

The fresh-water molluscan fauna from strata of the Salt Lake formation, 14 miles northwest of Logan, Utah, according to Yen (*7*, p. 272) indicates Pliocene age, perhaps late Pliocene. The ostracodes from the same locality as the mollusks were studied by Swain (*7*, p. 518), who found the assemblage modern in aspect except for three species whose ornamentation differs considerably from that of living relatives. The insect, fish, and bird remains have not been studied and evaluated.

In summary, the dwarfed, semiarid aspect of the flora from Cache Valley, the resemblance of the flora, with the exception of the extinct elm, to the living flora of Utah and adjoining States, and the evidence from the invertebrates point toward a probable middle to late Pliocene age for the flora.

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ENTOMOLOGY.—*The origin and classification of the trombiculid mites, or Trombiculidae.*[1] H. E. EWING, collaborator, Bureau of Entomology and Plant Quarantine.

The trombiculid mites, also known as the chigger mites, constitute the family Trombiculidae, a family which is not very well defined. However, the larvae of nearly all its species are peculiar among the members of the superfamily Trombidioidea in that they parasitize vertebrates rather than arthropod invertebrates. These larvae are characterized by progressive degrees of specialization in different directions from the generalized types which have characters linking them to the more generalized adult mites of the suborder Prostigmata.

The active nymphs and adults of trombiculid mites are characterized by nearly always having the abdomen strongly constricted behind the humeral region. In addition different members are structurally adapted for a concealed life usually in the bottom of moist herbaceous growth, in heavy forest litter, in caves, or in loose moist soil.

But little has been suggested as to the origin of trombiculid mites. In fact it has been only in the last few years (chiefly war years) that any extensive knowledge of their diversified structure, biology, and distribution has been attained.

EVOLUTION OR PHYLOGENY

The trombiculid mites and their relatives of such genera as *Tanaupodus* Haller and *Rhinothrombium* Berlese are probably among the most primitive or generalized of all the members of that branch of the suborder Prostigmata known as the thumbed mites

[1] Received March 2, 1949.

(i.e., mites having the palpal tarsus modified into a subapical thumb). This is particularly indicated by the generalized nature of the larvae of certain species in which the chelicerae show clearly their 2-segmented nature (the fanglike distal segment articulating with the basal segment as it does in the nymphs and adults), the palpi yet showing the palpal trochanter, the lobes of the palpal base (maxilla) yet being free and not forming a collar about the cheliceral fangs, and, finally, by the chaetotaxy of the abdomen, which shows a relatively small number of setae arranged in very definite transverse rows. Larvae with this combination of characters are not found in the insect- or arthropod-infesting species which make up the families of Trombidiidae and Erythraeidae.

For many years the writer had supposed that parasitism among the larvae of most of the thumbed mites must have arisen first with the species that parasitized arthropods, because of the great antiquity of both the mites and the Arthropoda. However, a study of the comparative anatomy of the vertebrate-infesting larvae with that of the arthropod-infesting larvae leaves but little doubt that parasitism arose with the vertebrate-infesting species in the Trombidiidae-Hydrachnidae complex (phalanx Phanerostigmata of Oudemans). The arthropod-infesting species have very highly modified cheliceral fangs, usually an apical rostral collar surrounding the cheliceral fangs, the chaetotaxy of the abdomen greatly modified by the disruption of the orderly arrangement of the setae in transverse rows, and the modification of the legs in many ways. Particularly the tarsi and the tarsal armature become greatly modified in some of these arthropod-infesting forms, the claws being transformed into various shapes, frequently being pectinate, or pectinate-plumose.

Although parasitism among the larvae of the Trombidioidea probably first arose with the parasitization of vertebrates, yet after being long established in this group, which in a broad sense we should call the Trombiculidae, there was some reversion among them, such as André has noted (1943, p. 294) in the case of *Acomatacarus paradoxus* (André), which parasitizes scorpions.

CLASSIFICATION

The trombiculid mites were for many years regarded as a subfamily of the Trombidiidae. The present writer (Ewing, 1944, p. 101) raised this subfamily to the rank of a family which was divided into two subfamilies, the type subfamily and a new subfamily, the Hemitrombiculinae.

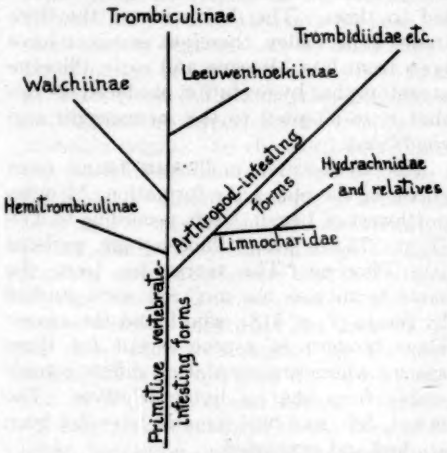

FIG. 1.—Diagram illustrating the suggested origin and relationships of the four subfamilies of Trombiculidae.

Michener (1946a, p. 349) has objected to such a change. He states: "Incidentally, it does not seem justifiable to recognize the latter group [Trombiculinae] as a separate family as has recently been done, especially when the other nine subfamilies are not also raised to family rank. It is far more logical to expand and enrich the classification by the use of subfamily and tribal names than by elevating each slightly distinct group to the family status." The answer to this thesis of Michener is that these groups are *not all* "slightly distinct groups" and that the trombiculid mites differ very much from the others in their biology and to a certain degree in their distribution.

Womersley (1945, p. 96) on the other hand not only recognizes the family Trombiculidae but has raised one of its subfamilies, his Leeuwenhoekiinae, to the rank of a family.

The classification here given is an extension and modification of the key to the four recognized subfamilies published in 1946

(Ewing, 1946, p. 435). It should be noted, however, that the four subfamilies recognized in 1946 are not equally distinct. The division between the Trombiculinae and the Leeuwenhoekiinae is not sharp, and is made in a somewhat different manner, as indicated in the key to the subfamilies farther on. This is due to the description of a new genus by Wharton (1947, p. 380) who, when describing the same, proposed an interesting new arrangement of the subfamilies of the Trombiculidae based on the number of segments in the legs.

The subfamilies Hemitrombiculinae and Walchiinae are very distinct and stand apart more or less from the rest of the Trombiculidae. In fact, the Hemitrombiculinae could be made a separate family between the Trombiculidae and the water mites of the family Limnocharidae. To regard the Hemitrombiculinae as water mites is not in accord either with their anatomy or habits and contrary to the indicated course of evolution.

TERMINOLOGY—NEW AND SOME OLD TERMS DEFINED

Most of the terms used in the taxonomy of the trombiculid mites are rather well known and understood. A few are here introduced for the first time. These, together with some of the older terms, are here defined.

Capitulum (Fig. 2, *cap.*): The most anterior division of the body, being that part which bears the mouth parts plus the region anterior to them. Gnathosoma, a term suggested by Oudemans for this part of the acarine body, has been employed to some extent by certain workers. However, there are two objections to its use. It is misleading in its implication for it is applied not only to the segments bearing the mouth parts but to the one (or two) in front of them. Also, if it were used to designate exclusively the segments bearing the mouth parts, it would not be equivalent to the gnathosoma of Insecta.

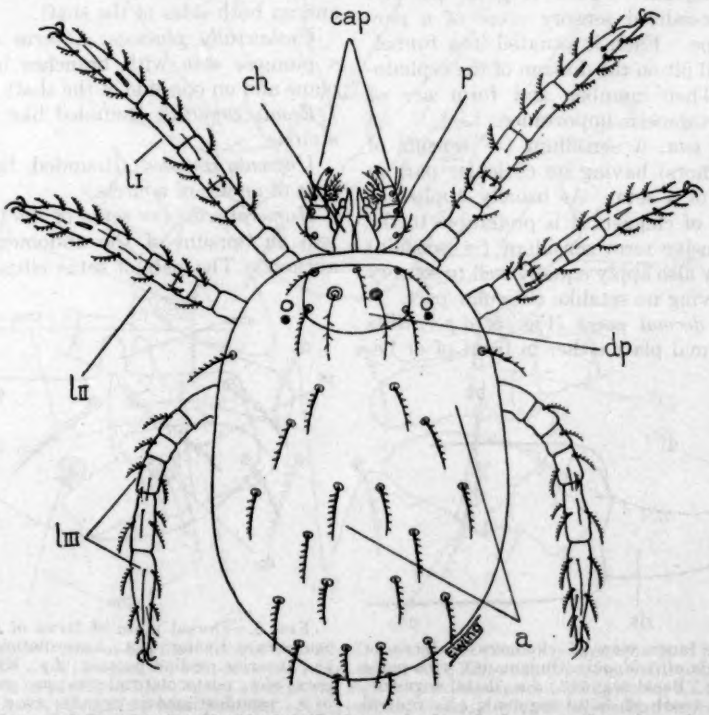

FIG. 2.—Larva of *Trombicula alfreddugèsi* (Oudemans), dorsal view greatly enlarged with larger parts labeled: *a*, Abdomen; *cap.* capitulum; *ch.*, chelicera; *d.p.*, dorsal plate; *l.I.*, leg one; *l. II*, leg two; *l. III*, leg three; *p.*, palpus.

Distal segment of chelicera (= *piercing element of chelicera* = *fang of chelicera*) (Fig. 3, *d.s.*): The distal segment of the 2-segmented chelicera. In the larvae of the Trombiculidae it usually is adapted to piercing and holding fast to the skin of the host.

Pseudochela: A dorsal, hyaline process arising from the base of the distal segment of the chelicera and extending forward above the cheliceral blade.

Palpal trochanter (Fig. 4, *p. tr.*): The first segment of the functional palpus, the coxa having been transferred to and fused with the capitular sternum. In many genera the palpal trochanter is partly or even completely fused with the palpal femur. Usually it is separated from the palpal femur by a distinct and true suture.

Axial prong of palpal claw (Fig. 4, *a.p.*): The chief prong, or, more specifically, the one that lies in the axis of the claw base.

Accessory prongs of palpal claw (Fig. 4, *ac. p.*): Other prongs than the axial prong.

Pseudostigmatic organs (Fig. 5, *ps. o.*): Paired specialized sensory setae of a particular type. Each is situated in a funnel-like dermal pit on the dorsum of the cephalothorax. Their number and form are of much phylogenetic importance.

Sensory seta: A sensillum (= sensilla of many authors) having its cuticular part in the form of a seta. As usually applied in the study of chiggers it is preferable to the more inclusive term sensillum (= sensilla) which may also apply equally well to sensory organs having no setalike cuticular part.

Slitlike dermal pores (Fig. 5, *d.p.*): Slits in the dermal plate either in front of or behind, or both in front of and behind, each pseudostigma.

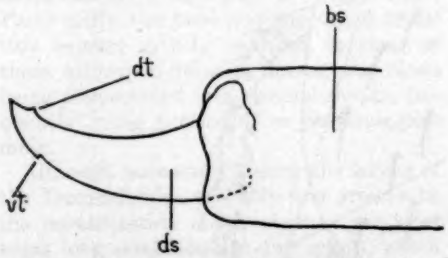

FIG. 3.—Inner view of chelicera of larva of *Eutrombicula alfreddugèsi* (Oudemans), with parts labeled: *b.s.*, Basal segment; *d.s.*, distal segment; *d.t.*, dorsal tooth of distal segment; *v.t.*, ventral tooth of same.

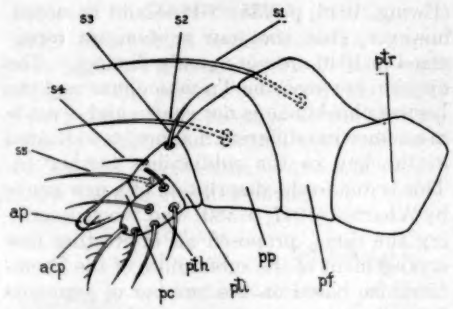

FIG. 4.—Ventral view of palpus of *Gahrliepia nana* (Oudemans), a generalized type of palpus in which the palpal trochanter is free and unreduced: *ac. p.*, Accessory prong of palpal claw; *a.p.*, axial prong of palpal claw; *p.c.*, palpal claw; *p.f.*, palpal femur; *p.p.*, palpal patella; *p. th.*, palpal thumb; *p. ti.*, palpal tibia; *p. tr.*, palpal trochanter; *s. 1*, seta one; *s. 2*, seta two; *s. 3*, seta three; *s. 4*, seta four; *s. 5*, seta five. (Adapted from Oudemans.)

Bilaterally plumose: A term applied to a plumose seta with branches in a single plane and on both sides of the shaft.

Unilaterally plumose: A term applied to a plumose seta with branches in a single plane and on one side of the shaft.

Evenly rounded: Rounded like the arc of a circle.

Unevenly rounded: Rounded, but not like that of an arc of a circle.

Humeral setae (= setae of the first row of two on dorsum of the abdomen, of most authors): The pair of setae situated in the

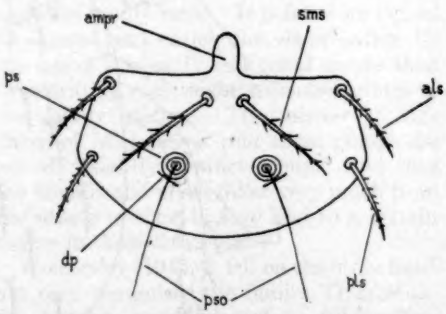

FIG. 5.—Dorsal plate of larva of *Comatacarus americanus* Ewing: *al.s.*, Anterolateral seta; *a.m. pr.*, anterior median process; *d.p.*, slitlike dermal pore; *pl.s.*, posterolateral seta; *ps.*, pseudostigma; *ps.o.*, pseudostigmatic organs; *sm.s.*, submedian seta.

anterolateral corners of the dorsum of the abdomen. They represent the displaced laterals of the true first row, and in a few species occupy their primitive position in this row. In formulae for the arrangement of the setae of the dorsum some authors have given the humeral setae, regardless of their position, as belonging to what most authors regard as the second row.

Capitular sternum (= *maxilla*, less palpal coxae): The sclerotized venter of the capitulum, without the fused palpal coxae.

Palpal base (= *maxilla*) (Fig. 6, *p.b.*): The capitular sternum plus the fused palpal coxae.

Outer lobes of palpal base (= *outer maxillary lobes*) (Fig. 6, *o.l.p.b.*): The outer pair of upcurved and usually incurved lobes of the palpal base. They nearly always bear a pair of setae and in most arthropod-parasitizing larvae they are modified to form a rostral collar.

Inner lobes of palpal base (= *inner maxillary lobes*) (Fig. 6, *u.l.p.b.*): The inner membranous pair of lobes of palpal base. They are wanting in some genera and bear no setae.

Rostral collar: The collar formed by the approximation or fusion dorsally of the outer lobes of the palpal base. Through this collar the piercing parts of the chelicerae protrude. The rostral collar is present in but few genera of the Trombiculidae and then is rather poorly formed. It is a structure correlated with the attachment of the cheliceral fangs or hooks to the sclerotized integument of arthropods.

Interpalpal setae (= *maxillary setae*) (Fig

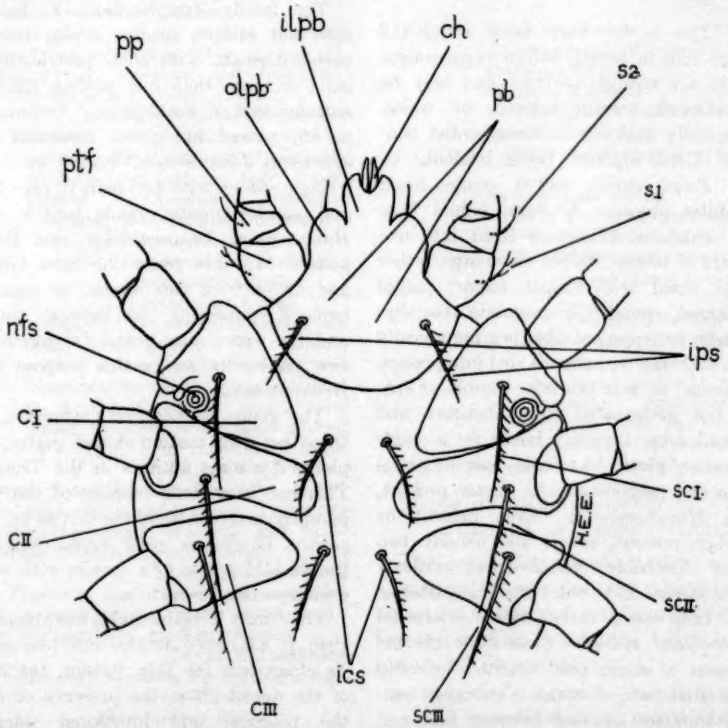

FIG. 6.—Ventral view of body of larva of *Trombicula autumnalis* (Shaw) (adapted in part from Hirst and from André): *Ch.*, Chelicera; *c.I.*, coxa one; *c.II*, coxa two; *c.III*, coxa three; *ic.s.*, intercoxal setae; *i.l.p.b.*, inner lobe of palpal base; *ip. s.*, interpalpal setae; *nf. s.*, nonfunctional spiracle; *o.l.p.b.*, outer lobe of palpal base; *p.b.*, palpal base (maxilla); *p. p.*, palpal patella; *p. tf.*, palpal trochanterofemur; *s. 1*, seta one of palpus; *s. 2*, seta two of palpus; *s.c.I.*, seta of coxa one; *s.c.II*, seta of coxa two; *s.c.III*, seta of coxa three.

6, *ip. s.*): The pair of setae situated on the palpal base between the two palpi. They apparently are the coxal setae of the palpi, and have been transferred to the palpal base by the fusion of the palpal coxae with the capitular sternum.

Intercoxal area (= *sternal area*): The venter of the cephalothorax between the coxae. Since trombiculid larvae have no sternum it appears improper to speak of the area between the coxae as the sternal area.

Intercoxal setae (Fig. 6, *ic. s.*): One or more pairs of cephalothoracic setae situated in the intercoxal area.

A DESCRIPTION OF THE FAMILY TROMBICULIDAE

A formal description of the family Trombiculidae Ewing based on larval characters is here given.

Larvae.—The larvae vary from about 0.2 mm to 0.35 mm in length before engorgement and usually are reddish in color but may be orange, yellowish, cream colored, or white. *Chelicera* usually showing its 2-segmented condition, the distal segment being bladelike or styliform. *Palpi* stout; palpal coxae fused with capitular sternum to form palpal base (maxilla), which is divided in front into one or two pairs of lobes. Palpal trochanter either distinct or fused with palpal femur; palpal femur enlarged, rounded or angulate laterally; palpal patella large; palpal tibia bearing apically a stout, curved claw, usually divided into prongs; palpal tarsus a seta-bearing thumb. *Cephalothorax* not demarcated from abdomen and all its dorsal setae typically borne by a single dorsal, median plate. A single pair of pseudostigmata and pseudostigmatic organs present, except in *Hemitrombicula*. Eyes present or absent; when present, sessile and usually two on a side. Ventrally cephalothorax without sternum or sternal rods but bears the platelike coxae, and from one to three pairs of intercoxal setae. *Functional spiracles* present or absent; when present a single pair situated laterally in front of first pair of coxae. Vestigial, nonfunctional spiracles situated between first and second coxae, but usually associated with first coxae. *Abdomen* almost circular except when distended due to feeding, then oblong. Abdominal setae in more generalized forms not numerous and in definite transverse rows, but becoming very numerous and disrupted from orderly arrangement in certain specialized species. No median plate on abdomen except in *Guntherana*, where it is posterodorsal and may be divided. *Legs* of moderate length and stoutness, 6- or 7-segmented; when 7-segmented the femur has become divided according to some authors. Segments of legs not greatly swollen and clothed chiefly with the usual curved setae, but some spines and long tactile setae also present. Tarsal armature typically consisting of three simple claws; in some cases only two claws present.

Type genus.—Trombicula Berlese, 1905.

Remarks.—The type genus is based on adults, but it is assumed that the larvae when reared will be found to have larval characters somewhat similar to the known larvae of adults closely related to those of the type species.

The family Trombiculidae as here defined does not include species having two pairs of pseudostigmata with their pseudostigmatic organs or more than one median shield on the anterior part of the dorsum. Oudemans (1912, p. 86) placed his genus *Rohaultia* (now by synonymy *Johnstoniana* George) which included a single species with two pairs of pseudostigmata and pseudostigmatic organs, next to the genera *Hannemania*, *Leeuwenhoekia*, and *Heterothrombidium*. In this genus the tarsi are 2-clawed and, in part for this reason, he regarded it as being a connecting link between these genera and the water mite genus *Limnochares*. However, it hardly serves this purpose as well as *Hemitrombicula*.

The genus *Blankaartia* Oudemans, in which there are two median dorsal plates, has been placed by some authors in the Trombiculidae. This has been done because of the belief, apparently in error, that the larvae on which the generic characters were based were those of trombiculid adults of a species with which they were associated in nature.

The family Trombiculidae has already (Ewing, 1946, p. 435) been divided into four subfamilies. As characters for this division the chaetotaxy of the dorsal plate, the presence or absence of the tracheae and functional spiracles, the presence or absence of true pseudostigmatic organs, and the nature of the tarsal claws and the body setae were used. To these characters, that of segmentation of the legs is here added.

CLASSIFICATION OF THE SUPERGENERIC GROUPS OF TROMBICULIDAE BASED ON LARVAL CHARACTERS

A. Dorsal plate without either median or submedian setae and without anterior median process; tracheae and functional spiracles absent.

B. Pseudostigmatic organs represented by unmodified, simple setae; tarsi two-clawed; body setae simple
Hemitrombiculinae Ewing
Genus: *Hemitrombicula* Ewing

BB. Pseudostigmatic organs true sensory setae; tarsi three-clawed but one or two claws frequently much reduced; body setae barbed or branched..Walchiinae Ewing
Genera: *Walchia* Ewing
Schöngastiella Hirst
Gahrliepia Oudemans
Gateria Ewing

AA. Dorsal plate with either a median seta or a pair of submedian setae on or near anterior margin and frequently with an anterior median process; tracheae and functional spiracles frequently present.

B. Dorsal plate without median seta but with two submedian setae; all legs six-segmented; tracheae and functional spiracles nearly always present
Leeuwenhoekiinae Womersley

C. Tracheae and functional spiracles present; distal segment of chelicera without pseudochela; tarsi three-clawed.....Division Tracheata
Genera: *Hannemania* Oudemans
Whartonia Ewing
Leeuwenhoekia Oudemans
Acomatacarus Ewing
Comatacarus Ewing

CC. Trachea and functional spiracles absent; distal segment of chelicera with a dorsal, hyaline process, the pseudochela, which extends almost to tip of cheliceral blade; tarsi either two-clawed or three-clawed
Division Atracheata
Genus: *Chatia* Brennan

BB. Dorsal plate with a median seta, except in *Apolonia* in which genus all legs are seven-segmented; tracheae and functional spiracles usually absent
Trombiculinae Ewing

C. Tracheae and functional spiracles present; dorsal plate usually with an anterior, median process
Division Tracheata
Genera: *Apolonia* Torres and Braga
Womersia Wharton
Odontacarus Ewing

CC. Trachea and functional spiracles absent; dorsal plate never with a true anterior, median process, but may be outwardly rounded at median line..Division Atracheata (contains four sections)

D. Distal segment of chelicera adapted for piercing or cutting; palpi seldom bent inward as if for clasping.

E. Middle tarsal claw not stouter than paired claws; eyes nearly always present.

F. Pseudostigmatic organs usually clavate or capitate never setiform or flagelliform.....Section I
Genera: *Schöngastia* Oudemans
Endotrombicula Ewing
Oenoschöngastia Womersley and Kohls
Neoschöngastia Ewing
Ascoschöngastia Ewing
Euschöngastia Ewing
Doloisia Oudemans
Guntherana Womersley and Heaslip

FF. Pseudostigmatic organs setiform or flagelliform, and with or without barbs or lateral branches
Section II
Genera: *Heaslipia* Ewing
Novotrombicula Womersley and Kohls
Crotiscus Ewing
Fonsecia Radford
Trombiculindus Radford
Trombicula Berlese
(With three subgenera; see pp. 235–236)
Eutrombicula Ewing
(With two subgenera; see p. 236)
Tecomatlana Hoffmann

EE. Middle tarsal claw stouter than paired claws; eyes absent
Section III
Genus: *Riedlinia* Oudemans

DD. Distal segment of chelicera not adapted for piercing or cutting but blunt and with two, large, toothlike processes; palpi strongly bent inward as if for clasping.....Section IV
Genus: *Myotrombicula* Womersley and Heaslip

NOTES ON THE TAXONOMY OF CERTAIN GENERA OF TROMBICULIDAE

The genus *Trombicula* Berlese is based on a species known only in the adult stage, hence its subgenera are here separated in a key using adult characters. Key to the subgenera of *Trombicula*:

A. Eyes well developed and situated far in front of area sensilligera; palpal tibia slender, about three times as long as broad; large trombiculids occurring in tropical or subtropical regions of both hemispheres
Subgenus *Pentagonella* Thor

AA. Eyes usually poorly developed or absent, when present not situated in front of area sensilligera; palpal tibia short, robust, not three times as long as broad. Usually medium to small trombiculids.

B. Palpal claw truncate apically; pseudostigmata greatly enlarged, each being more than one half width of area sensilligera in diameter. Contains only a single, small species taken in Java
Subgenus *Trombicula* Berlese

BB. Palpal claw not truncate; pseudostigmata not greatly enlarged, never more than a small fraction of width of area sensilligera in diameter. Species found in many parts of the world
Subgenus *Leptotrombidium* Nagayo et al.

Recent rearing experiments have shown that the adults of the genera *Eutrombicula* Ewing and *Acariscus* Ewing are very close together hence the latter genus is here reduced to a subgenus. Key to the two subgenera of *Eutrombicula* Ewing based on larval characters follows:

Dorsal abdominal setae twenty-two (counting posterior marginals and dorsolaterals of row IV) and in unengorged larvae arranged, 2-6-6-4-2-2; ventral abdominal setae of row I, six, middle pair being anterior to others; dorsal plate broader than long and with posterior margin broadly outcurved
Subgenus *Eutrombicula* Ewing

Dorsal abdominal setae more than twenty-two and with different formula; dorsal plate variously shaped.....Subgenus *Acariscus* Ewing

In the key to the genera of trombiculids given by the writer (Ewing, 1945 (1944), p. 346) the genus *Endotrombicula* Ewing was given under a category description which stated "Pseudostigmatic organs setiform or flagelliform. . . ." This statement was in accord with the description of the type species of the genus which evidently was made from specimens in which the distal part of these organs was broken off. Now Dr. H. S. Fuller writes in a letter to the author that he has obtained additional material of the type species, *E. penetrans* Ewing, taken from the same individual frog that the type specimens came from. Concerning these he states: "On one of my specimens, the complete pseudostigmatic organ is in place and intact, and it is clavate." Thus *Endotrombicula* has characters similar to those of certain species of *Schöngastia* and these *Schöngastia* species should be transferred to the redefined genus *Endotrombicula*. *Endotrombicula* may be separated from *Schöngastia* as follows:

Piercing part of chelicera with small to minute teeth of a varying number; median seta of dorsal plate barbed or plumose; not parasitic on frogs
Schöngastia Oudemans

Piercing part of chelicera with three or four conspicuous teeth or toothlike processes which increase in size with their distance from the apex; median seta of dorsal plate simple or with vestigial barbs; parasitic on frogs
Endotrombicula Ewing

The relationship of the members of the genus *Acomatacarus* Ewing to those of the subfamily Microtrombidiinae has been clearly indicated by the recent rearing of the nymphs of three species of the former group. Nymphs of two of these species were reared by Maj. G. M. Kohls and of the other species by Lt. Col. C. B. Philip. These nymphs have been described by Womersley (1945) and are remarkable for not having the abdomen constricted and in this respect differing from the nymphs and adults of other trombiculids. This characteristic, as well as the shape and dimensions of the leg segments and the setose clothing of the body, are so nearly those of the adults of the subfamily Microtrombidiinae that Womersley transferred to *Acomatacarus* three species known only in the adult stage that had formerly been placed in the Microtrombidiinae.

Pentagonella Thor, is here regarded as a subgenus of *Trombicula*, and is considered as having as a synonym *Megatrombicula*, established as a subgenus of *Trombicula* by Michener (1946b, p. 432). Michener reported on rearing experiments which certainly show that the adults in this subgenus are very similar to those described by Berlese (1912, p. 96) under the name of *Blankaartia nilotica* (Trägårdh). These adults are of particular interest. According to Berlese (1912, p. 98) the position of the eyes in them indicates a connection with *Microtrombidium* Haller. That *Pentagonella* is to be regarded as possibly being a generalized type is indicated by the large number of subapical spines on the palpal tibia of the adult. On the other hand, the fact that at least one species lays its eggs in masses, as shown by Michener, would indicate a relationship with the more specialized genera in which the

larvae are parasitic on arthropods. The larvae of *Pentagonella* are much like those of the different members of *Trombicula* and therefore are not of a specialized type.

Speotrombicula Ewing, a genus based exclusively on adults, contains but a single, peculiar cave species which evidently is specialized for its life in a cave environment. This species is blind and has the front pair of legs adapted especially for crawling and climbing by being much enlarged, sclerotized and provided with trifurcate claws. Members of *Speotrombicula* are very large (length, 2.7 mm) being even larger than the members of the subgenus *Pentagonella* Thor of the genus *Trombicula*. The affinities of *Speotrombicula* are not clear, and probably will remain so until the larval stage of its single species is known.

ACKNOWLEDGMENTS

In the preparation of this paper the writer has been aided especially by three of his colleagues of the Bureau of Entomology and Plant Quarantine: R. E. Snodgrass assisted in the selection of technical terms used; C. F. W. Muesebeck encouraged the work in various ways; and E. W. Baker aided greatly in the study of specimens and in various other ways. Recently Snodgrass (1948) has published an important paper on *The feeding organs of Arachnida, including mites and ticks.* This work proved to be of much value in interpreting the mouthparts of mites.

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ZOOLOGY.—*Chalcogorgiinae, a new subfamily of Chrysogorgiidae (Coelenterata: Alcyonaria), and a description of* Chalcogorgia pellucida, *new genus and new species, from the Straits of Florida.*[1]

FREDERICK M. BAYER, U. S. National Museum. (Communicated by FENNER A. CHACE, JR.)

The early cruises of the U. S. Fish Commission steamer *Albatross* resulted in large collections of interesting and unusual deep-sea invertebrates, many of which for want of interested specialists have found their way to the deepest recesses of the "miscellaneous unidentified" section of the National Museum collections. This is especially true of the less conspicuous creatures, a category into which many of the alcyonarian corals fall without effort. Among these neglected creatures is a chrysogorgiid so unusual that it seems remarkable it should have remained unnoticed until now. Its characters are so divergent from the ordinary that I am here establishing for it a new subfamily as well as a new genus and species.

The family Chrysogorgiidae was established by Verrill in 1883 (p. 21) to include *Chrysogorgia, Dasygorgia* (=*Chrysogorgia*), and *Iridogorgia* and was placed between the Ceratoisidae (=Isididae) and the Primnoidae. Verrill saw in its lustrous, calci-

[1] Published by permission of the Secretary of the Smithsonian Institution. Received March 2, 1949.

fied axis an alliance to the Primnoidae, and in the sharp demarcation of its calcareous base from the less calcareous stem a possible relationship to the Isididae. Hickson, one of the foremost students of the Alcyonaria, saw it as "a family without any well-defined characters" (1930, p. 250), a view which is difficult to understand. It has been studied in detail only by Versluys (1902), who put the family in excellent order as of his time. He divided the Chrysogorgiidae into three subfamilies: the Lepidogorgiinae for *Lepidogorgia* (now = Radicipedinae for *Radicipes*); the Chrysogorgiinae for *Chrysogorgia*, *Metallogorgia*, and *Iridogorgia*; and the Riiseinae for *Riisea* and *Pleurogorgia*. At the time of its proposal, it was a convenient arrangement which provided for all the genera then known, but subsequently described species in several genera have again made the classification inadequate. In its zooidal arrangement and manner of branching, *Trichogorgia* Hickson seems to fall into none of Versluys's subfamilies, although in certain respects it approaches closest to the Chrysogorgiinae. *Pleurogorgia militaris* Nutting appears to resemble *Pleurogorgia plana* Versluys (the genotype) only in its manner of branching, while other features indicate a relationship to *Iridogorgia*. For the time being it is probably best to place *Trichogorgia* in the Chrysogorgiinae and permit the Pleurogorgiae to occupy the same subfamily despite their differences. The new subfamily, the fourth, contains at present only one genus and species, from the Straits of Florida. The characteristics of this singular new species definitely corroborate Verrill's belief that the family Chrysogorgiidae is related to the Primnoidae. Since its basal disk is not more calcareous than is the stem, and is not conspicuously jointed to it, the species does nothing to strengthen the theory of relationship with the Isididae. On the other hand, the character of the spicules in *Riisea* indicates a closer relationship of the chrysogorgiids with the Gorgonellidae. Unfortunately for this theory, certain of the isidids exhibit in their spiculation a striking similarity to members of the Chrysogorgiidae. The most recent arrangement (Hickson, 1930, p. 250; Stiasny, 1937, p. 135) places the family at the end of the Holaxonia, with which I can not agree. It is not, however, my purpose to revise the classification of the Chrysogorgiidae or to theorize as to its possible relationship to other families, but merely to provide a place for the unique form described in the following paragraphs.

Family Chrysogorgiidae Verrill

Chalcogorgiinae, n. subfam.

Unbranched chrysogorgiids arising from a spreading basal disk; axis partially calcified, and having metallic lustre; zooids biserially arranged; distal zooidal scales broad, folding over the oral disk as a well-formed operculum; sclerites typical double plates with rounded ends, and in the zooids large, irregularly lobed plates.

Chalcogorgia, n. gen.

Colony unbranched, arising from a spreading basal disk which is not more heavily calcified than the axis with which it is continuous; axis partially calcified, with noticeable bronzy iridescence; zooids biserially arranged; distal spicules of the zooids forming a definite operculum which folds down almost flat over the mouth and retracted tentacles; tentacles without spicules; sclerites of the zooid body large, lobate overlapping scales; coenenchyma packed with elongate, flat scales having rounded ends and a median constriction.

The name is derived from the Greek χαλκός = bronze, + gorgia.

Genotype.—Chalcogorgia pellucida.

Chalcogorgia pellucida, n. sp.

The whiplike colony is 130 mm high, arising from a basal disk almost surrounding a small bit of rock (Fig. 1, *c*). The axis is partially calcified but rather flexible and exhibits a beautiful metallic luster. At a point 4 cm from the base it is 0.3 mm in diameter, at 7 cm it is 0.25 mm, and at the apex it is drawn out to an exceedingly fine point. At approximately 7 mm above the base a single row of zooids begins on each side of the stem (Fig. 1, *a*), the members of the two rows being either opposite or alternate to each other. Zooids (Fig. 1, *b*) 1.5–2.0 mm long, directed distally and adherent to the stem. They are unique among the Chrysogorgiidae in possessing a well-developed operculum consisting of eight triangular scales (Fig. 1, *k–n*)

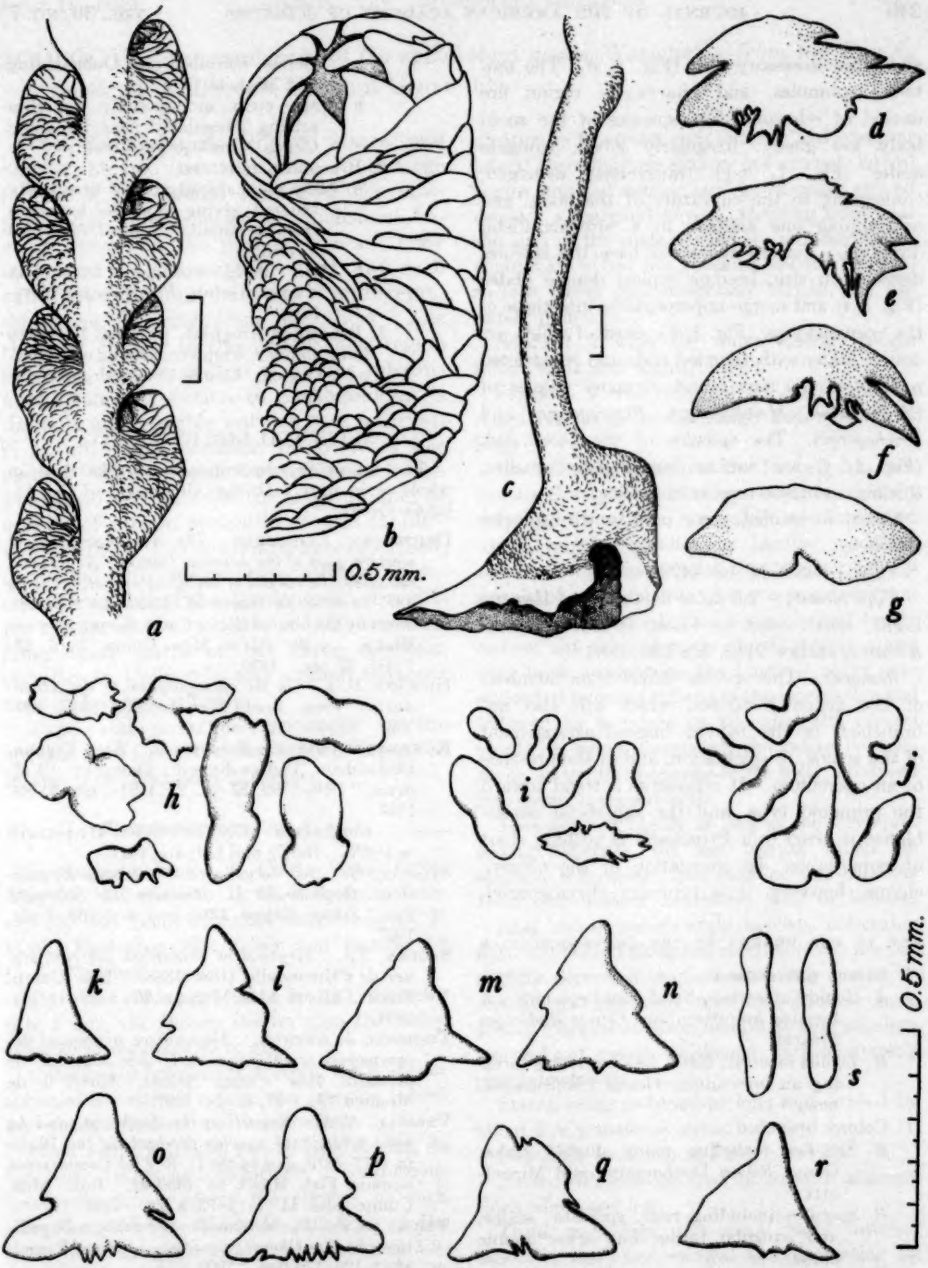

FIG. 1.—*a*, Part of stem, showing biserial arrangement of the zooids (line to right of figure represents 1 mm); *b*, a single zooid, showing arrangement of the operculum and the body scales; *c*, the basal disk and proximal sterile part of the stem (line to right represents 1 mm); *d–g*, scales from the upper part of the zooid body (scale at lower right corner of plate applies to all spicules); *h*, spicules of the coenenchyma, about the middle of the stem; *i*, spicules from the basal part of the zooid; *j*, spicules of the basal disk; *k–r*, the opercular scales; *s*, accessory rods of the operculum.

and a few accessory rods (Fig. 1, *s*). The tentacles, pinnules, and pharyngeal region are devoid of sclerites. The spicules of the zooid body are glassy, irregularly lobed, elongate scales (Fig. 1, *d–g*) transversely arranged, conforming to the curvature of the body, and overlapping one another in a proximal-distal direction. Toward the zooid base the spicules decrease in size, become typical double plates (Fig. 1, *i*) and merge imperceptibly into those of the coenenchyma (Fig. 1, *h*), most of which are double plates with rounded ends and constricted middle, of the sort found in many species of *Chrysogorgia*, *Metallogorgia*, *Pleurogorgia*, and *Trichogorgia*. The spicules of the basal disk (Fig. 1, *j*) are similar but slightly smaller, thicker, and more regular in outline.

Color, in alcohol, very pale brown; spicules colorless.

Type.—U.S.N.M. no. 44220.

Type locality.—2.5 miles northwest of Havana Light, north coast of Cuba, in 387 fathoms. *Albatross* station 2152, April 30, 1884.

Remarks.—This species differs from members of the genus *Radicipes*, which are also unbranched, in the regular biserial arrangement of the zooids, in spiculation, and in the presence of an operculum. It represents a trend toward the primnoid type, and the superficial resemblance it bears to a *Primnoella* is nothing short of remarkable. In spiculation of the coenenchyma, however, it is typically chrysogorgiid.

KEY TO THE GENERA OF THE CHRYSOGORGIIDAE

I. Colony unbranched:
- *A*. Zooids uniserial; distal zooid spicules not forming an operculum: Genus *Radicipes* Stearns.
- *B*. Zooids biserial; distal zooid spicules forming an operculum: Genus *Chalcogorgia*, new.

II. Colony branched:
- *A*. Spicules including many double clubs: Genus *Riisea* Duchassaing and Michelotti.
- *B*. Spicules including rods, spindles, scales, and irregular forms, but never double clubs:
  - *1*. Branching dichotomous beyond main stem:
    - *a*. Main stem sympodial, giving off branches in a spiral around stem: Genus *Chrysogorgia* Duchassaing and Michelotti[1]
    - *b*. Main stem monopodial, branches arising irregularly near its apex: Genus *Metallogorgia* Versluys.
  - *2*. Branching unilateral:
    - *a*. Main stem spirally coiled or spirally twisted, giving off simple branches from its outside: Genus *Iridogorgia* Verrill.
    - *b*. Main stem straight, branchlets simple: Genus *Pleurogorgia* Versluys.
  - *3*. Branching irregular, terminal branches long, slender, whiplike, arising on upper part of stem: Genus *Trichogorgia* Hickson.

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[1] The spiral arrangement is obscure or irregular in some species, but there is never a long monopodial main stem.

ZOOLOGY.—*New millipeds of the spiroboloid genus* Watichelus *from the Pacific coast.*[1] H. F. LOOMIS, Coconut Grove, Fla.

The Southwestern United States and nearby Mexico are the home of a large family of spiroboloid millipeds, the Atopetholidae, most species of which have become known in the past 30 years. They appear to be extremely localized, and each suitable locality may have one or more representatives differing from all others. The rigors of climate in this usually arid region are such that migration of humus inhabitants from one section to another often is difficult and possible only at rare intervals if at all. This isolation of localities has caused "island faunas" of millipeds to develop and accounts for the large number of species of certain genera in several families there today. The new forms here described, combined with the genotype, furnish an excellent example of the development of multiple species in a limited area for all have come from small parts of the three southern counties in California and a small adjacent area in Lower California.

Type and paratype specimens of the species here described have been deposited in the U. S. National Museum.

Watichelus robustus, n. sp.

Specimens collected at Chula Vista, Calif., May 31, 1917 (female), by H. F. Loomis; January 23, 1921 (male type and female), by O. F. Cook; December 1921 (male and female) by C. G. Marshall.

Description.—Length 45 to 50 mm, diameter 6 to 7 mm, the females stouter than the males. Number of segments 40 to 42.

Color in alcohol chestnut-brown, the posterior subsegments darker except the margins, which are nearly colorless and transparent.

Head with the frontal groove long, the one on the vertex short and indistinct; a conspicuous transverse furrow above the clypeus on each side; the obliquely transverse striations of the front moderately deep; clypeal punctures 5-5; eye patch subtriangular and with about 30 ocelli arranged in seven longitudinal rows.

First segment slightly wider than segments immediately following, a distinct median emargination in front and with anterior and posterior lateral emarginations shallow but evident; lateral angles long and slender but not strongly curved caudad; a marginal groove extending from near the apex of the angle beyond the anterior lateral emargination but not reaching behind the eye; surface feebly and irregularly striate and minutely punctate.

Segment 2 with the anteroventral margin rather thick and slightly raised.

Segment 3 with the ventral crest abruptly raised on the outer side, high and moderately long.

On following segments the forebelt has numerous closely placed transverse striae; midbelt very slightly convex, noticeably aciculated and with a very few punctations; hindbelt smoother and somewhat more shining than midbelt, faintly aciculated and punctate; transverse constriction shallow, the surface behind it slightly and evenly convex, not rising abruptly; dorsal median sulcus very faint, evident on the hindbelt only; pore somewhat removed in front of the constriction and followed by a sulcus on the hindbelt; ventral striations deeply impressed, the ridges between them, on the third quarter of the body, produced into strong marginal teeth.

Last segment hardly as long as the three preceding segments, the last two of which are strongly telescoped; apex rounded and with the transverse median impression faint or lacking.

Anal valves not strongly swollen, noticeably flattened behind along the margins which are but slightly depressed; surface with very coarse irregular wrinkles near opening. Preanal scale evenly rounded at apex; margin at base subsinuate and not greatly thickened; surface sparsely punctate-striate.

Sterna twice as broad as long and crossed by about five transverse striae.

Gonopods as shown in Figs. 1 and 2.

Males with ventral crest of seventh segment thick, short and low.

Third male legs with coxal lobes directed caudally, the lobes vertical and decreasing on ensuing legs.

Watichelus edentatus, n. sp.

A single male type collected on the eastern side of the mountains beside the road from San

[1] Received February 17, 1949.

Diego to El Centro, Calif., January 29, 1921, by O. F. Cook.

Diagnosis.—Distinguished by the more acute and bent lateral angles of the first segment and its shorter marginal groove, the lack of dentations on the hind margin of any of the segments, and by the male gonopods.

Description.—Length 38 mm; diameter 5 mm. Number of segments 46.

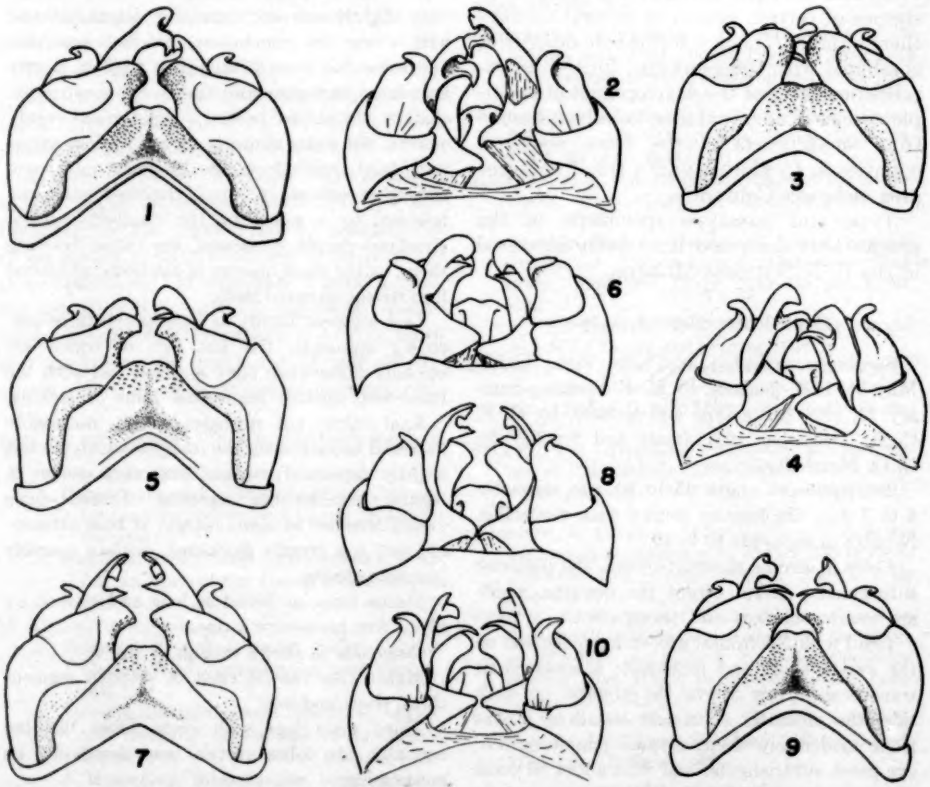
Head with a distinct median line on front and vertex but the two not joined; vertex finely rugulose; front with faint oblique transverse striations; clypeal punctures five on each side; eyes orbicular, composed of 25 or 26 inconspicuously raised ocelli in six longitudinal rows.

Segment 1 not wider than the following segments; the anterior median emargination broad and shallow, that above the acute lateral angle on each side long and distinct, the produced angle strongly bent backward and with the posterior margin above it more deeply emarginate than in the other species; marginal impressed line short, extending half the distance from the angle to the eye; surface very feebly and sparsely punctate, coarsely and irregularly striate.

Segment 2 with the anterior lateral margin not conspicuously raised.

Segment 3 with ventral crest abruptly raised, high, but short.

Following segments with the transverse constriction shallow, the surface behind it hardly convex; forebelt smooth and crossed by several long transverse striae; midbelt with numerous fine, short, irregular striae and a few feeble punc-



FIGS. 1–10.—1, 2, Gonopods of *Watichelus robustus*, n. sp., anterior and posterior views respectively; 3, 4, gonopods of *Watichelus edentatus*, n. sp., anterior and posterior views, respectively; 5, 6, gonopods of *Watichelus cooki*, n. sp., anterior and posterior views, respectively; 7, 8, gonopods of *Watichelus emarginatus*, n. sp., anterior and posterior views, respectively; 9, 10, gonopods of *Watichelus parallelus*, n. sp., anterior and posterior views, respectively.

tations; hindbelt less striate but with distinct punctures widely placed; pore located well in advance of the constriction, in the midbelt, and followed by the impressed lateral sulcus on the hindbelt well above the line of the pores; ventral striations not as strong as in the other species and with the ridges between them not produced beyond the margin of the segment in sharp teeth.

Last segment broadly rounded, as long as the four preceding segments together; the penultimate segment is very short with the other three longer but subequal in length.

Anal valves scarcely exceeding the last segment, shining, the sides with widely scattered punctations and a few coarse wrinkles near the opening below the apex of the last segment.

Preanal scale nearly four times as wide as long, broadly rounded but subsinuate on each side; surface somewhat shining and with numerous impressed longitudinal aciculations.

Sterna of the legs two-thirds as long as broad.

Gonopods as shown in Figs. 3 and 4.

Male legs with coxal lobes small, those of the third legs largest, not caudally produced.

Ventral crest of seventh male segment rather thin and of moderate height and length, slightly excavated on either side in front to receive the tips of the gonopods.

Watichelus cooki, n. sp.

A male (type) and female collected at Descanso, Lower California, January 1, 1931, by O. F. Cook.

Diagnosis.—Near *edentatus*, but with several differences of the gonopods and with the posterior lateral margin of some of the segments toothed.

Description.—Length 38 to 40 mm; width 5 mm.

Head with 29 to 31 ocelli in a rounded cluster of six or seven rows, median sulcus of vertex faint, sulcus of front strong; front crossed by five or six oblique transverse wrinkles, clypeal fovea five each side.

First segment wider than succeeding segments, with lateral angles acute and bent backward, both margins above the apex emarginate, the anterior emargination deeper and more extensive and with a margining rim to behind eye, no median emargination; surface aciculate-punctate.

Second segment with ventral anterior margin rather thin but little elevated.

Crest of segment 3 short but raised into a sharply triangular lobe.

Segments with lateral sulcus strongly impressed on hindbelt, the median sulcus not or only very faintly impressed, transverse constriction slight; forebelt crossed by several faint striations; midbelt smooth, hindbelt very minutely punctate; lateral striations quite distinct, the adjacent margin with a few small teeth projecting beyond it; pore in midbelt, directly in front of the lateral sulcus.

Last segment as long as the three preceding segments together, broadly rounded and with a slight depression before the apex.

Anal valves quite strongly inflated, little flattened behind, meeting in a deep groove; surface more or less coarsely wrinkled.

Preanal scale three times as broad as long.

Sterna less than twice as broad as long crossed by five or six striations.

Gonopods as shown in Figs. 5 and 6.

Ventral crest of seventh segment short, thick, high and inclined sharply backward.

Coxal of male legs 3–6 little produced, those of legs 7 more so.

Watichelus smithi (Chamberlin)

Watichelus smithi (Chamberlin), Proc. Acad. Nat. Sci. Philadelphia **99**: 49–50. 1947.

This is the smallest and slenderest species of the genus and with only four clypeal fovea. The gonopods bear some resemblance to those of *cooki*, but differences are obvious.

Watichelus emarginatus, n. sp.

Three males (one the type) and a female from Lower California, "8 miles down" (below Tia Juana), January 1, 1925, O. F. Cook.

Diagnosis.—The less heavily constructed, more slender, inner gonopods, and the definitely emarginate penultimate segment distinguish this species.

Description.—Length 30 to 42 mm; width 4 to 5.5 mm. Number of segments 42–44.

Head with a distinct median sulcus on front and a faint one on vertex; surface with impressed, sometimes anastomosing, lines; clypeal fovea five on each side; ocelli about 32 in seven rows.

Segment 1 as wide as the next segments, with angles moderately produced and bent backward, a strong submarginal sulcus reaching to behind the eye; anterior and posterior emargination strong.

Segment 2 with anterior ventral margin thin and elevated.

Segment 3 with ventral crest rising abruptly into a triangular projection.

Segments with transverse constriction scarcely evident; forebelt transversely crossed by five or six almost continuous striae; midbelt faintly aciculated, otherwise smooth; hindbelt punctate and with minute longitudinal scratches; pore well in front of the hindbelt, followed by the impressed sulcus; median sulcus seldom evident; lateral striations well impressed, the upper posterior surfaces between them developed into minute marginal teeth, penultimate segment with a short but definite emargination of the back margin at middle.

Last segment as long as the three preceding segments, rather narrowly rounded behind, the apex usually preceded by a slight transverse depression.

Preanal scale broadly rounded, about three times as broad as long, surface smooth.

Anal valves moderately inflated, surface very coarsely wrinkled.

Sterna nearly twice as broad as long, crossed by six or seven striae.

Gonopods as shown in Figs. 7 and 8, with the inner gonopods more slender and less sturdy than in the other species.

Seventh segment of male with ventral crest moderately thick, long and high, inclined backward, and with the anterior face each side excavated to receive the tips of the gonopods.

In the males the coxal lobes of third legs are thicker but not as high as those of the legs that follow, where the lobes are subequal in size.

Watichelus parallelus, n. sp.

Collected at Chula Vista, Calif., January 23, 1921 (male and female), by O. F. Cook, and December 1921 (male type) by C. G. Marshall.

Diagnosis.—Distinguished by the strongly trifurcate inner gonopods, the pronounced denticulate segment margins, and the short angles of the first segment.

Description.—Length 36 to 40 mm; width 5.3 to 6 mm. Number of segments 40 to 42.

Head with the median grooves of the front and vertex distinct; vertex rugose along posterior portion; front with a strong transverse furrow either side of the median groove with other oblique and less distinct furrows above the transverse one; clypeus with five fovea each side; eye patch suborbicular, composed of about 30 ocelli in six rows.

Segment 1 as wide as the succeeding segments; lateral angle on each side shorter and not narrowed as much as in the other species although it still is curved backward somewhat.

Segment 2 with the anteroventral margin thin and greatly raised.

Segment 3 with ventral crest thin, rather short, and moderately raised.

Succeeding segments with the forebelt transversely striate; midbelt flat, not in the least convex, finely and thickly aciculated longitudinally; hindbelt punctate, inconspicuously striate, hardly more shining than midbelt; the transverse constriction distinct, the posterior subsegment evenly and rather strongly convex; pore located in front of the constriction; median and lateral grooves impressed on the hindbelt only, the latter behind or a little above the line of the pores and not showing the distinct offset apparent in *edentatus*; ventral striations pronounced, the upper corners of the areas between them produced beyond the hind margins of the segments into sharp, slightly upcurved teeth, especially conspicuous on the third quarter of the body.

The four segments preceding the last strongly telescoped and together about equalling it in length.

Last segment crossed behind middle by a broad variably evident impression; apex evenly rounded.

Anal valves vertical, moderately inflated and meeting in a shallow groove; surface with fine punctations and larger ones on the sides, and also with a number of coarse irregular striations.

Preanal scale longer than in other species, broadly rounded; surface shining and with a suggestion of punctures and short scratches.

Sterna of the legs two-thirds as long as broad, the sides nearly parallel.

Gonopods as shown in Figs. 9 and 10.

Segment 7 of male with ventral crest thick, high, and long.

Coxal lobes of third male legs vertical, thicker but not so high as those of fourth and fifth legs.

Another species that eventually may need to be placed in this genus is *Atopetholus paroicus* Chamberlin (Bull. Univ. Utah **31**: 7. 1941), based on females only, whose outstanding character was the first segment, which is typical of that in *Watichelus*. Males from the type locality will be needed to determine the correct generic assignment.

ORNITHOLOGY.—*A note on* Corythus splendens *Brehm.*[1]

ALEXANDER WETMORE, Smithsonian Institution.

Understanding of the geographic races to be recognized among the pine grosbeaks (*Pinicola enucleator*) of eastern North America has been subject to uncertainty, owing to the fact that most of the skins now in museums represent migrants, taken between fall and spring, with no indication as to their summer homes. The breeding range is mainly in distant, northern forests where it has been difficult to secure representative specimens. It has been hard, therefore, to judge to what degree the evident variation among them is individual or is representative of geographic segregation. Ludlow Griscom, in his excellent study of the pine grosbeaks of eastern North America,[2] has recognized two subspecies in this area, and has assigned to these the various scientific names that are applicable. The two forms that he recognizes, which are accepted by the A. O. U. Committee on Classification and Nomenclature, may be summarized as follows:

Pinicola enucleator leucura (Müller), marked by larger size, broader bill, and lighter coloration, particularly in the red of adult males: Breeds from Northwest Territories and northern Alberta to northern Quebec and Labrador, ranging south in winter to the northern United States from Nebraska to western Pennsylvania, more rarely to New England.

Pinicola enucleator eschatosus Oberholser, of smaller size, with narrower bill, in color slightly darker gray, with the red of the males more scarlet, less rosy: Breeds from Newfoundland south to Nova Scotia, northern Maine, and New Hampshire, south in winter to southern New England and New York, casually farther.

Several names that have been applied to these birds by the older authors are not determinable as to race from the data given in the original descriptions, so that Griscom has exercised the right of the first reviser to designate the form, of the two that he recognizes, to which they are to be applied. He has done this wisely, in a manner that has avoided useless changes in nomenclature. One of his allocations, however, that of *Corythus splendens* Brehm, has required consideration in connection with the current revision of the A. O. U. Check-list, since the specimen on which Brehm based his name is still extant, a fact of which Griscom in 1934 was unaware.

The type of *Corythus splendens* Brehm, an adult male in full plumage, formerly in the Brehm collection in Lord Rothschild's Museum, is now no. 457089 in the Bird Department of the American Museum of Natural History, where the authorities have kindly placed it in my hands for study. The bird was mounted, and has been remodeled as a study skin by straightening the neck and the legs, and by cutting off the wires that formerly held it to a perch. An original label, on narrow paper, is marked in written characters with carbon ink "*Corythus splendens* ♂ alt hieme Jan. 1833. Nordamerika." The bird is in excellent condition, with only slight fading from light exposure, and that confined mainly to the ends of the primaries and the tail. The crown and sides of the head are jasper red, the rump coral red, the breast and throat light coral red, and the reddish edgings on the back duller than jasper red.

Since Brehm's type, the reason for the present study, is a male, the following remarks are based entirely on an examination of male specimens. Examination of the series of pine grosbeaks in the National Museum substantiates Griscom's recognition of two groups on the basis of color, of which one, centering in Newfoundland and spreading to adjacent regions, is definitely darker. This dark bird also is small, as is shown by measurements of an excellent series of 17 males from Newfoundland, collected mainly by H. S. Peters and T. D. Burleigh: Wing 110.8–115.9 (113.5), tail 81.5–91.4 (85.8), culmen from base 13.6–15.9 (15.3), width of bill at base 9.0–9.9 (9.6), tarsus 21.2–23.1 (22.3) mm. The color differences are considered of major importance, as they are more distinctive, darker color being a general

[1] Received February 8, 1949.

[2] Proc. New England Zoöl. Club **14**: 5–12. 1934.

characteristic of other races of birds recognized from the Newfoundland area. The size is variable and is, therefore, less certainly diagnostic. One bird from Ingonish, Nova Scotia, taken July 4, 1942, agrees fully with the Newfoundland series in darker color, and also is small in size. Its measurements are: Wing 109.0, tail 80.4, culmen from base 15.4, width of bill at base 9.6, tarsus 22.3 mm.

On analysis of the lighter colored specimens, in which the red of the males is more rosy, less scarlet, and the gray somewhat paler, one point develops that Griscom did not mention, namely, that these separate into two general groups on basis of size. In the larger set, measurements of 16 males are as follows: Wing 114.4–121.8 (117.1), tail 86.0–94.1 (89.8), culmen from base 15.0–16.4 (15.5), width of bill at base 10.0–11.0 (10.2) mm. Griscom has restricted the name *Loxia leucura* of P. L. S. Muller[3] to this larger group of individuals. In the series in the U. S. National Museum five males from Fort Chimo, northern Quebec, taken from April 13 to June 20, represent breeding birds of *leucura* on this basis.

A second series is smaller, measurements of ten winter males from Franklin County, Maine, Ossipee and South Sutton, N. H., Cambridge, Mass., Lake George, N. Y. (one), and the Emsdale District, Ontario (one), being as follows: Wing 108.0–115.4 (112.2), tail 80.6–87.8 (84.3), culmen from base 14.5–15.9 (15.2), width of bill at base 9.1–9.8 (9.5), tarsus 21.9–22.8 (22.2) mm. Possibly these represent intermediates between *eschatosus* and *leucura*, having the size of the former and the color of the latter.

The type of *Corythus splendens* Brehm is definitely light in color, like *leucura*, and has the following measurements: Wing 113.0, tail 89.7, culmen from base 15.7, width of bill at base 9.7, tarsus 21.8 mm. It thus agrees more closely in size with the smaller group. Should the smaller, lighter-colored individuals prove to have a broad enough breeding range to warrant their recognition as another eastern subspecies the name *splendens* may be available for them. In the meantime it can be stated definitely that this name does not affect the recognition of the breeding form of Newfoundland and Nova Scotia as *Pinicola enucleator eschatosus*, since Brehm's type, in lighter gray and brighter red, is like the large specimens of *leucura* where Griscom has allocated the name *splendens*. The darker color of the birds whose breeding area centers in Newfoundland is so pronounced both in shades of gray and of red that this character outweighs the slighter one of small size difference.

As stated above, Brehm's type, marked as taken in 1833, in North America, is of uncertain provenience, so that Griscom's restriction of the type locality to the city of Quebec can be accepted. The published basis for the name *Corythus splendens* is brief like many others of the earlier period, so brief in fact that without the type specimen proper identification would be impossible. Brehm[4] in some general remarks prefactory to an article on the birds of prey of Germany, mentions the Hakengimpeln, or pine grosbeaks, and says that "der amerikanische ist viel prächtiger, als der europaische, und soll desswegen *Corythus splendens* heissen." To say that a bird is brighter colored or prettier is far from a definite statement, but is in a sense descriptive. The only other use of the name *Corythus splendens* by Brehm is in some rambling natural-history observations made in America in 1845 and 1846[5] where he writes: "Vor etwa 6 vochen flog ein Vogel in das geoffnete Fenster der Frau Prof. N. Trügt mich nicht alles, ist es *Corythus enucleator* Cuv.*). Ich habe denselben erhalten; er schient mir aber kleiner zu sein als *Cor. enucleator.*" And then below in a footnote is found "**Corythus splendens* Brm." From the text Brehm at the time was probably in Cambridge, Mass., though he does not say so definitely. In any event, the remarks have doubtful pertinence, since they do not refer to the type of 1833 but to another bird taken at the end of winter or in early spring of 1846, a specimen that so far as known is not extant. Actually, typical *Pinicola enucleator enucleator* of Europe is also a small race.

Burleigh and Peters[6] have identified their Newfoundland specimens properly as *escha-*

[3] Natursyst. Suppl.: 150. 1776.

[4] Isis von Oken, 1840: 590.

[5] Allg. Deutsche Naturh. Zeit. **1** (6): 535. 1846.

[6] Proc. Biol. Soc. Washington **61**: 123. 1948.

tosus, which they collected also in summer on Petite Miquelon, and at Ingonish, Nova Scotia. Van Tyne[7] has recorded two size groups among pine grosbeaks from Michigan and Ohio, calling the smaller ones *eschatosus*. Sutton[8] reports two from Tompkins County, N. Y., on the same basis. In the light of the discussion above, and the present acceptance of two forms, it would seem necessary to re-examine the latter birds on the basis of color to determine where they are to be placed under the current recognition of only two forms in this area, viz. *leucura* and *eschatosus*.

[7] Auk, 1934: 529–530.
[8] Auk, 1948: 125–126, pl. 5.

Obituaries

DWIGHT F. WINDENBURG was born in Lamont, Iowa, on May 14, 1895. After graduation from high school in 1912, he taught in the public schools of Iowa until he entered Cornell College, in Mount Vernon, Iowa, in 1916.

He left college during World War I to join the Navy, where he served afloat as a radio operator from December 1917 to March 1919. Following this duty he served as a radioman in the U. S. Merchant Marine for some 15 months.

Returning to Cornell College in Iowa, he graduated in 1921, and received his master's degree in physics from this college in 1923. He was a member of Phi Beta Kappa and Sigma Xi fraternities.

From 1923 to 1929 he taught mathematics in California, successively at the University of California, the Polytechnic College of Engineering at Oakland, and the Long Beach Junior College. At the last two institutions he served as head of the departments of mathematics.

In January 1929 he joined the staff of the U. S. Experimental Model Basin at Washington as a physicist, the first member of a group undertaking research and development in structural mechanics, of which he was later to become the head. He devoted the major part of his time to a project involving the strength of submarine hulls under external pressure, on which subject he became an authority in this country. Largely as a result of his efforts, there was developed the first external-pressure vessel code to be promulgated in the United States. As a leading member of the special research committee on the strength of vessels under external pressure of the American Society of Mechanical Engineers he participated in all the subsequent revisions of this code up to the time of his passing, which occurred on November 14, 1947.

When the new David Taylor Model Basin was commissioned in 1940, Dr. Windenburg, who has the year before obtained his Ph.D. degree from the Catholic University of America, was placed in charge of the structural mechanics division. Under his supervision and guidance, this division greatly expanded its activities until in the course of World War II it undertook important research and development for the Bureau of Ships in under-water explosion phenomena and action, the design and strength of turret structures, the invention and development of torpedo countermeasures, and many other allied projects. In recognition of this valuable work, he was awarded the Distinguished Civilian Service Award of the U. S. Navy Department.

As a part of his many activities he was a member of the Society for Experimental Stress Analysis, the Philosophical Society of Washington, the Washington Academy of Sciences, and the Instrument Society of America, of which he was vice-president of the Washington chapter. He served from time to time as a special lecturer in the graduate school of physics at the Catholic University.

Following World War II, Dr. Windenburg, who had throughout his governmental career taken a keen interest in the problems of the scientist working under Civil Service, was instrumental in bringing about many necessary changes in the methods of recruiting and examining applicants for these positions. Upon its establishment he was made a member of a pioneering group in the Potomac River Naval Command known as the Board of United States Civil Service Examiners for Scientific and Technical Personnel.

HAROLD E. SAUNDERS.

WILLIAM RALPH MAXON was born at Oneida, N. Y., on February 27, 1877, the son of Samuel Albert and Sylvia Louisa (Stringer) Maxon. He entered Syracuse University in 1894 and received the degree Ph.B. in 1898. After graduating he

accepted a temporary position at the New York Botanical Garden. On January 9, 1899, he was appointed aid in cryptogamic botany at the U. S. National Herbarium, Smithsonian Institution, and he remained with the Institution for nearly 50 years, retiring as curator of the National Herbarium in May, 1946. Syracuse University conferred the honorary degree Sc.D. in 1922. He died suddenly of a heart attack in Terra Ceia Fla., on February 25, 1948. He is survived by his wife, Edith Hinckley Merrill Maxon, and a daughter, Mrs. Mary Maxon Bergh.

Dr. Maxon was an internationally known student of ferns and the chief authority on the ferns of the United States. His interest in ferns began in college, where he prepared a thesis, never published, entitled *A contribution to the biology of the hart's-tongue fern*. His productivity in his earlier years was very great, and his published papers number 201, almost all on ferns. In later years Maxon's failing health made research work difficult, and he never lived to finish his larger projects, which he often worked on, but never got on paper. His major published work, other than his treatment of the ferns in Small's *Flora of the Southeastern States*, in Britton and Brown's *Illustrated Flora of the Northeastern United States and Canada*, and in Abram's *Illustrated Flora of the Pacific States*, is *Pteridophyta of Porto Rico*, the only modern, accurate treatment of the ferns of any part of tropical America. This work will remain indispensable for the study of West Indian ferns for many years.

Dr. Maxon's ability as an administrator was perhaps as important as his scientific contributions. His willingness to identify specimens brought in continual shipments of ferns from all over the world, which resulted in increasing the fern collection of the National Herbarium from negligible size to probably the largest in the world. Also by sponsorship of expeditions, by extensive exchanges, and by judicious purchases he brought the general collection of the National Herbarium up to one of the largest in the world. His own care in administrative detail doubtless had its influence on his colleagues in other institutions. Although professing boredom with administrative work, he really loved it, but, like many of us, he often wished that there were more hours in the day, so that he could devote time also to work on his *Ferns of Jamaica*, the research project in which he was most interested.

Maxon was a well-known and well-liked figure in botanical circles. He was a member of many scientific societies, and president of the American Fern Society for many years. Although in his later years he rarely traveled or attended scientific meetings, his official position and his extensive correspondence kept him in touch with fellow botanists. He had a genial and hearty nature and a delightful sense of humor. He will be long remembered by those who were fortunate to know him.

C. V. MORTON.

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THE WASHINGTON ACADEMY OF SCIENCES has at its disposal $596.50, made available by the American Association for the Advancement of Science for the purpose of assisting young and promising scientists engaged on or planning worthy research projects. Grants may be used for the purchase of necessary equipment and supplies, or for compensation to an assistant, but may not be used to defray the costs of publication, or of typing the manuscript. The recipient of a grant is required to make progress reports on blank forms furnished by the A.A.A.S.

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J. LEON SHERESHEFSKY, Chairman
Committee on Grants-in-Aid
Chemistry Department
Howard University
Washington 1, D. C.

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